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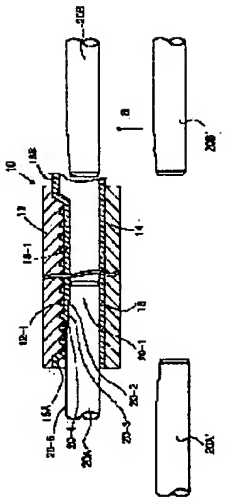
(54) LINEAR-DRIVE TYPE FORM ROLLING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a linear-drive type form rolling method and a device therefor in which unevenness of any arbitrary shape with deep engraving can be efficiently formed with high precision.
SOLUTION: Mandrels 20A, 20B are press-fitted in a cavity in the axial direction of a stock while holding the stock 18 of deformed section between an upper die 12 and a lower die 14 having unevenness 12-1 on an inner surface thereof, the material of the stock is expanded by the metal flow toward the unevenness 12-1 of the upper die 12 by tapered portions 20-2, 20-4 of the mandrel and expansion portions 20-3, 20-5 continuous thereto, and a shape copying the unevenness 12-1 of the inner circumference of the upper die is formed on the outer circumference of the stock 18. The stock 18 has the piercing cavity between ends thereof, and the mandrel 20A and the mandrel 20B are simultaneously press-fitted from one end of the stock 18 and the other end of the stock 18, respectively in the right-and-left direction.



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CLAIMS

[Claim(s)]
[Claim 1] Two or more split molds of the horizontal division arranged in piles in a longitudinal direction, and the bed for laying a split mold, pressurizing so that it may insert into the split mold arranged in piles in a longitudinal direction from the both sides of opposite Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne. -- the base of the variant cross section of the shape of two or more straight line -- type material to each split mold with the pressurization means which carries out pressurization maintenance It has a rodding press fit means for pressing fit all at once towards the cavity of the shaft orientations of type material. each base held at each split mold in two or more rodding held by the rodding holder which estranges two or more rodding in parallel with a longitudinal direction, and holds it, and the rodding holder -- base -- the base by press fit of rodding to type material -- the base of plurality [formation / of the configuration according to the irregularity of the metal mold inner circumference to the periphery of type material] -- the straight-line drive type shaping rolling equipment characterized by being carried out at once about type material.
[Claim 2] pressurizing two or more lining up side-by-side and arranged split molds and each split mold in the direction of mold doubling -- the base of a variant straight-line-like cross section -- with a pressurization means to make type material hold, respectively The stacker for holding two or more rodding holders estranged in parallel in the shape of a pile according to the order of two or more processes, A means to return a used holder to a rodding holder while taking out one holder of the arbitration of the rodding holders held in the shape of a pile at the stacker from a stacker, It has the rodding press fit and the pull back means for pressing fit all at once and pulling back towards the cavity of the shaft orientations of type material. the base which was held by the one rodding holder and held at the split mold of correspondence by rodding -- Straight-line drive type shaping rolling equipment characterized by being carried out to a multistage story by rodding from which the rodding holder was taken out from the stacker according to the order of a process every [1], and press fit of rodding to each ** type material differed from two or more rodding holders accumulated on the stacker.
[Claim 3] Straight-line drive type shaping rolling equipment characterized by forming in claim 1 or 2 the space wide opened outside above metal mold in invention of a publication, and installing the loader for insertion of the material to metal mold, and taking out of a product in this space.
[Claim 4] It is straight-line drive type shaping rolling equipment characterized by every one thing [holders / two or more / which the stacker was installed in the both sides of a split mold in invention given in claim 1 or 2, and were accumulated on the stacker /

rodding] performed on a multistage story by rodding from which the rodding holder was taken out from the stacker of both sides by turns according to the order of a process, and press fit of rodding to each ** type material differed.
[Claim 5] The both-way drive for rodding [in / on invention according to claim 4 and / the rodding holder from one near stacker] and the both-way drive of rodding in the rodding holder from the stacker of the opposite side are straight-line drive type shaping rolling equipment characterized by driving to independent timing.
[Claim 6] pressurizing a split mold and a split mold in the direction of mold doubling -- the base of a variant straight-line-like cross section -- a pressurization means make type material hold, and the base which were held in rodding at the split mold -- the straight-line drive type shaping rolling equipment characterized by to have an oil hydraulic cylinder means for pressing fit and pulling back towards the cavity of the shaft orientations of type material, and to be attached this oil hydraulic cylinder means in the reverse bending rib for bending include-angle offset.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] the base of a trigonum with the cavity of shaft orientations in this invention, a rectangular head, multiple, an anomaly, and which circular cross-section configurations of various kinds of -- a part of type material or the whole front face -- concavo-convex processing of the gestalt of the deep arbitration of a lump [carve] -- a high precision -- and, if an example is given about the straight-line drive type shaping equipment formed efficiently Although it is applicable to manufacture of the rack bar which are the steering components of an automobile, it is applicable to this invention giving the desired shape of surface toothing and a desired pattern not only to manufacture of a rack bar but to various kinds of machine functional part and ornament components.
[0002]
[Description of the Prior Art] The technique which fabricates the rack bar which are the steering components of an automobile by rolling from ****** type material is theoretically well-known. That is, in rolling shaping of a rack bar, flattening of the rack forming face of a hollow rod is performed by covering a press, holding first the ****** type material softened with heating with a mold. Next, rodding is pressed fit in the cavity of a hollow rod from an outside, applying a die with the row of teeth of the direction of a

straight line to inner circumference at said flat part of a hollow rod. Rodding has the taper-like operation section, when the taper section engages with a flat part at an inner circumference side, the meat of a flat part is jutted out by flowing in plastic deformation towards a die, and the row of teeth of the direction of a straight line of a ****** configuration is given to a flat part at the row of teeth of a die. Only by one press fit of the core bar, since the product of an expected precision is not obtained, processing it, while the diameter of an operation arranges the core bar which carried out sequential change in a turret mold and makes a sequential change of the diameter of an operation of the core bar is proposed.

[0003]

[Problem(s) to be Solved by the Invention] In the thing of a turret mold, the turret from which the diameter of an operation changes for every split mold is required, the product obtained by one press fit actuation is only a piece, and it got worse to the degree of pole as productive efficiency, and since the merit of the rack bar manufacture by forging was hardly able to be employed efficiently, practical use was hardly presented with the thing of a turret mold until now. This invention is made in view of this trouble, it cancels the fault of a turret mold, it does not have a cutting article and inferiority in precision while it realizes coincidence manufacture of two or more products by enabling simultaneous press fit of two or more core bar, and it aims at enabling it to press down in cost and cheaply moreover.

[0004] Two or more split molds of the horizontal division which is arranged in piles in a longitudinal direction according to invention according to claim 1, pressurizing so that it may insert into the bed for laying a split mold, and the split mold arranged in piles in a longitudinal direction from the both sides of opposite Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne. -- the base of the variant cross section of the shape of two or more straight line -- type material to each split mold with the pressurization means which carries out pressurization maintenance It has a rodding press fit means for pressing fit all at once towards the cavity of the shaft orientations of type material. each base held at each split mold in two or more rodding held by the rodding holder which estranges two or more rodding in parallel with a longitudinal direction, and holds it, and the rodding holder -- base -- the base by press fit of rodding to type material -- the base of plurality [formation / of the configuration according to the irregularity of the metal mold inner circumference to the periphery of type material] -- the straight-line drive type shaping rolling equipment characterized by being carried out at once about type material is offered.

[0005] two or more rodding by which the welding pressure according [if an operation and effectiveness of invention of claim 1 are explained, as for the split mold of longitudinal direction division, plurality will be arranged at a horizontal pile, and] to the pressurization means from both sides to the split mold of a horizontal pile was held with the holder in addition ** and where each ** type material is clamped with each split mold -- each base -- the cavity of type material -- it is pressed fit all at once and rolling of each ** type material is performed to coincidence. At this time, the overturning moment which joins a bed from a split mold by rodding press fit becomes being the same as that of the case where the number of split molds is one. Although the pressurization means which was in agreement with the number of sets of a split mold is needed when a split mold tends to be made into vertical division and it is going to clamp this up and down all at

once as lining up side-by-side, and the clamp force becomes huge and each split mold is clamp use separately In this invention, by making a horizontally divided split mold into a horizontal pile, and clamping from lateral both sides, a pressurization means can be substituted for a piece, without completely increasing the clamp force, and very [in cost] advantageous effectiveness can be acquired.

[0006] Two or more split molds lining up side-by-side and arranged according to invention according to claim 2, pressurizing each split mold in the direction of mold doubling -- the base of a variant straight-line-like cross section -- with a pressurization means to make type material hold, respectively The stacker for holding two or more rodding holders estranged in parallel in the shape of a pile according to the order of two or more processes, A means to return a used holder to a rodding holder while taking out one holder of the arbitration of the rodding holders held in the shape of a pile at the stacker from a stacker, It has the rodding press fit and the pull back means for pressing fit all at once and pulling back towards the cavity of the shaft orientations of type material. the base which was held by the one rodding holder and held at the split mold of correspondence by rodding -- A rodding holder is taken out from a stacker according to the order of a process every [1] from two or more rodding holders accumulated on the stacker, and the straight-line drive type shaping rolling equipment characterized by being carried out to a multistage story by rodding from which press fit of rodding to each ** type material differed is offered.

[0007] if an operation and effectiveness of invention of claim 2 are explained -- a rodding holder -- rodding of the processing stage -- several -- collecting -- it should become -- it is held free [attachment and detachment] by one-touch, and the rodding holder of each processing stage is set to a stacker in the shape of a pile according to processing sequence. It is pressed fit in type material all at once. the base of the correspondence clamped by the split mold with rodding lining up side-by-side which the rodding holder was taken out from the stacker according to processing sequence, and was held at the rodding holder -- Rodding is drawn out after termination of a press fit process. After several repetitions of press fit and pull back The rodding holder which ** was also re-contained by the stacker and held rodding of the following order of processing by actuation of a shift of a stacker etc. is taken out for a rodding holder from a stacker, and rodding is the receipt to the press fit-********** stacker of rodding like the following. - The ejection of the rodding holder of the next phase is repeated. It is effective in the ability to carry out multistage story rolling actuation very efficiently by this configuration.

[0008] According to invention according to claim 3, in invention of a publication, the space wide opened outside above metal mold is formed in claim 1 or 2, and the straight-line drive type shaping rolling equipment characterized by installing the loader for insertion of the material to metal mold and taking out of a product in this space is offered.

[0009] If an operation and effectiveness of invention of claim 3 are explained, since insertion of a material and taking out of a product can be performed from the upper part of the metal mold wide opened with the loader, effective use of space is realized and the whole equipment is made into a compact.

[0010] According to invention according to claim 4, in invention according to claim 3, a stacker is installed in the both sides of a split mold, and the straight-line drive type shaping rolling equipment characterized by every one thing [holders / two or more / which were accumulated on the stacker / rodding] performed on a multistage story by

rodding from which the rodding holder was taken out from the stacker of both sides by turns according to the order of a process, and press fit of rodding to each ** type material differed is offered.
[0011] if an operation and effectiveness of invention of claim 4 are explained, since a rodding holder will be taken out from a stacker on either side one by one according to the order of a process and rodding of the taken-out rodding holder will be pressed fit alternately with right and left -- the rolling of the deep concavo-convex pattern on the front face of a thin wall tube -- precision -- there is effectiveness which can be carried out highly.
[0012] According to invention of claim 5, in invention according to claim 4, the straight-line drive type shaping rolling equipment characterized by driving to the timing that the both-way drive for rodding in the rodding holder from one near stacker and the both-way drive of rodding in the rodding holder from the stacker of the opposite side are independent is offered.
[0013] If an operation and effectiveness of invention of claim 5 are explained, it is realizable that selection of the drive timing of right-and-left independence raises the compatibility over a limited-production-with-a-wide-variety system, changes a product which is different with one set of a machine stage picking, and produces it by the minimum nothing or paragraph ****.
[0014] pressurizing a split mold and a split mold in the direction of mold doubling according to invention according to claim 6 -- the base of a variant straight-line-like cross section -- with a pressurization means to make type material hold the base held in rodding at the split mold -- it has an oil hydraulic cylinder means for pressing fit and pulling back towards the cavity of the shaft orientations of type material, and the straight-line drive type shaping rolling equipment characterized by attaching this oil hydraulic cylinder means in the reverse bending rib for bending include-angle offset is offered.
[0015] If an operation and effectiveness of invention of claim 6 are explained, in implementation of this invention, the clamp direction of a split mold and the press fit direction of rodding will tend to serve as arrangement which intersects perpendicularly X and in the shape of [of Y] a cross joint. In this cross-joint arrangement, since it is maintenance of workability that the pressurization means of a Y-axis also prepares a stanchion in the middle, the pressurization means of the X-axis is also difficult, and it becomes a cantilevered suspension. In this case, opening of the protrusion jaw by stress distortion occurs structurally, and it is easy to produce a gap in a pressurization axial center. This gap has a possibility of shortening the life of rodding. On the other hand, in the 7th invention, by not preparing a direct cylinder in the jaw of a pressurizer, but adding the reverse bending rib for bending include-angle offset, and preparing a cylinder in this, distortion of an opposite direction can arise mutually between a jaw and a rib, and distortion can be negated, or it can be made small, and a gap of an axial center can be made into prevention or min.
[0016]
[Embodiment of the Invention] Drawing 1 and drawing 2 show roughly rolling formation of the hollow rack which are the steering components of the car from the metal tube as 1 operation gestalt of this invention. The metal mold 10 as a split mold consists of a punch 12 and female mold 14, and shows the cross section of drawing 2 and metal mold 10 in the state of closing in an open condition and (b) in (b). The punch 12 has the rack gear-

tooth-like tooth part 12-1 in the die-length direction crevice in the inner skin which faced female mold 14, and, on the other hand, female mold 14 forms the die-length direction slot 14-1 of a cross-section semicircle arc in the top face facing a punch 12. (b) of drawing 2 shows the condition that the tube 18 was already laid in the cross-section semicircle arc die-length direction slot 14-1 of female mold 14.

[0017] the variant base in which the upper half 18-1 where a tube 18 faces a punch 12 is crushed evenly, and should receive the shaping rolling of a rack gear tooth if metal mold 10 is closed like (b) of drawing 2 by moving a punch 12 and female mold 14 in the direction which faces mutually from the condition of (b) of drawing 2 -- it becomes type material. Drawing 1 shows the die-length direction sectional view of the metal mold 10 in the closing condition shown in (b) of drawing 2 . Metal mold 10 has only about 1 / two or less die length of the material tubing 18 of a circular cross section. And although the ends of a tube 18 are metal mold 10 and a field 1, the opposite end is projected one half of more than die length. However, if it has stopped to the front a little from the end face of metal mold 10, crushing of left end 18A and right end 18B of the material tubing 18 is not evenly carried out in the closing condition of metal mold 10 but the tooth part 12-1 formed in the inferior surface of tongue of a punch 12 facing female mold 14 is put in another way, both-ends 18A of the material tubing 18 and 18B have stopped with the circular cross section.

[0018] flattening [of the top face which is a rack forming face of the material tubing 18 with the operation gestalt of this invention explained to drawing 1 and drawing 2] = -- formation of ****** type material -- rack rolling formation -- public funds -- closing of a mold 10, i.e., the coalesce with a punch 12 and female mold 14, is performing. That is, since the rack-like tooth part 12-1 of a punch 12 comes to the place whose distance from the base of female mold 14 is the one half strength of the outer diameter of the material tubing 18 at the time of metal mold closing, the material tubing 18 is evenly crushed, as the rack-like tooth part 12-1 of a punch 12 shows to (b) of drawing 2 . Therefore, the sequential shift of the metal mold 10 can be carried out continuously as it is at the following process, without carrying out a mold aperture. Thereby, while being able to carry out [lap]-izing of the process, since clamp actuation can be made only into 1 time of the beginning, there is an advantage which can lose the opportunity of generating of the blemish by the clamp. Moreover, since the mold for rolling was used for anomaly-izing, the precision of anomaly-izing had a fall as compared with the case where the original mold only for anomaly-izing is used, but unless the precision prescribe was very high, it actually turned out that there is no upper problem. It is more as possible as a taking-usual process which crushes top face of tube with mold of dedication for flattening, and carries out mold aperture after that and which is clamped to metal mold for rolling peach.

[0019] In drawing 1, a split mold 12 and the material tubing 18 after cross-section flattening held among 14 receive the rolling process of this invention by press fit and pull back of rodding. Hereafter, if this is explained, when clamped by metal mold 10, rodding 20A and 20B will counter shaft orientations, and will be arranged at the both sides of ******** 18 to which flattening of the top face was carried out. Rodding 20A and 20B have the ****** cross-section configuration in the cross-section configuration of the part of the material tubing 18 by which cross-section flattening was carried out as the cross-section configuration was shown in (b) of drawing 2 . As shown in drawing 1 , the tip of

rodding 20A and 20B is making the interior 20-1 of a proposal, and serves as a guide of installation into the part of the material tubing 18 by which cross-section flattening was carried out. Back inside [20-1] a proposal, the diameter expansion section 20-3 continues via the taper section 20-2. When the taper section 20-2 engages with the flat part 18-1 of the material tubing 18 at the time of press fit of rodding 20A and 20B, from inside, turn the meat of material tubing outside at the irregularity of the rack dentate part 12-1 of metal mold, and it carries out a metal flow. The allocated type of the rack-like tooth part complementary in the shape of [the] toothing is carried out to the flat part 18-1 of material tubing. In drawing 1 , rodding 20A and 20B follow the 1st diameter expansion section 20-3, the 2nd diameter expansion section 20-5 continues through the taper section 20-4, and a metal flow of the sequential multistage story by one rodding is obtained.

[0020] The first condition pressed fit in the material tubing 18 to the extent that flattening of the left-hand side rodding 20A was carried out as the 1st process in drawing 1 is shown. It is moved towards left-hand side a line crack and after that until extraction of the rodding 20A is carried out completely and it results from the material tubing 18, until, as for press fit of left-hand side rodding 20A, the last diameter expansion section 20-5 reaches at the right end of the flat part 18-1 of material tubing.

[0021] With the timing difference of the extraction of left-hand side rodding 20A, and suitable wrapping, right-hand side rodding 20B starts migration on the left-hand side of drawing 1 , and the process of the same metal flow as that with which right-hand side rodding 20B came to be introduced into the internal cavity of the material tubing 18, and explained left-hand side rodding 20A to be by the diameter expansion section is caused.

[0022] The press fit-extraction of left-hand side rodding 20B continued to the press fit-extraction of right-hand side rodding 20A and this is repeated several times. That is, press fit of rodding 20A of the right and left to the material tubing 18 and 20B is repeated two or more times by turns. A positive flow of meat to the crevice of metal mold can be urged to repeat-press fit of each rodding 20A to the internal cavity of the material tubing 18, and 20B. That is, although just one press fit of rodding of the flow of meat is insufficient and there is a possibility that rolling with a high precision cannot carry out, such fear is avoidable with repeat-press fit. Moreover, an equal metal flow to the crevice of metal mold can be obtained by mutual press fit of the multiple times of rodding 20A on either side and 20B, and it is effective in rolling with a high precision being realizable. That is, drawing 3 expresses typically the flow condition of the meat grasped from the stratification condition of the tooth part in the cross-section microphotography of the tooth part of the actual rack obtained by rolling. It turns out that the flow condition of the meat of this invention that performs mutual press fit as shown in an arrow head f1 is expressed with (b), and the symmetrical flow condition is acquired. On the other hand, it turns out that accept and come out, the flow condition in a certain case is shown, and deviation is in a flow of meat in this case, and contamination has occurred while [whose press fit direction of rodding is / like / (b) / an arrow head f2]. The uneven flow condition of such meat makes the return of the elastic strain accompanying the uneven stress residual and this uneven after the completion of shaping of a rack gear tooth, i.e., the ununiformity of the amount of springbacks, cause, and although it becomes the cause of a precision fall of a product, since a flow of equal meat is secured in this invention, such a trouble is canceled.

[0023] Again, if the shift of the vertical direction of rodding is explained in drawing 1 , two or more pairs which consist of rodding 20A on either side and 20B are prepared up and down. drawing 1 -- the pair of rodding 20A and 20B -- although the pair of another rodding 20A' and 20B' is shown caudad, the rodding pair of a required number of stages is arranged in the vertical direction. The configuration of rodding, such as a diameter of an operation, is changing gradually in the shift direction so that processing may progress a phase to ** of a shift later on. Two or more steps of rodding pairs are loaded into the stacker on either side which is not shown in drawing 1 , and processing is performed, shifting a stacker. Namely, after performing the 1st-step processing by pressing rodding 20A of the first processing stage, and 20B fit by turns, The rodding holder in a stacker on either side is shifted upward like an arrow head a at the time of standby. Rodding 20A' of the 2nd step and 20B' are made to align by the material tubing 18, it is made to press rodding 20A' and 20B' fit in the internal cavity of the material tubing 18 by turns, the 2nd-step processing is carried out, and processing of a need number of stages is carried out like the following. thus, the thing for which rodding is changed little by little and much processings are performed over a stage -- material tubing of closing in -- also receiving -- the allocated type of the shape of deep toothing -- precision -- there is highly realizable effectiveness.

[0024] (b) of drawing 4 - (d) explain the rate structure of the metal mold for endowing the shape of toothing with various kinds of ****** type material and it which can carry out this invention. (b) of drawing 4 shows material 18A which carried out flattening of the upper half of the tube explained in relation to drawing 1 and 2. Metal mold consists of punch 12A and female mold 14A, punch 12A faces the flat part of material 18A, and has concave heights 12A-1, and the shape of complementary toothing is formed in the flat side of material 18A of press fit of rodding at this irregularity.

[0025] (b) of drawing 4 shows material 18B of a rectangle cross section, and material 18B is clamped between punch 12B and female mold 14B. Punch 12B faces one side face of material 18B, and has concave heights 12B-1, and irregularity complementary to this irregularity is formed in one side face of material 18B of press fit of rodding.

[0026] Three are carried out comparatively. (Ha) of drawing 4 shows material tubing 18C of 6 square-shape cross section, and metal mold consists of 12C, 12C', and 14C -- They are concavo-convex 12C-1 and 12C' to the inside of each split mold 12C, 12C', and 14C. - 1 and 14C-1 are formed and irregularity complementary to this irregularity can be formed in the side face in every other one of 6 angle cross-section material tubing 18B by press fit of rodding.

[0027] (d) of drawing 4 shows material tubing 18D of 3 square-shape cross section, it consists of punch 12D and female mold 14D, concavo-convex 12D-1 is formed in the inside of punch 12D, and metal mold can form irregularity complementary to this irregularity in the top face of 3 angle cross-section material tubing 18D by press fit of rodding.

[0028] material tubing of drawing 5 is flat -- surface 12A-1 and 12 -- various kinds of variations of the shape of toothing given to B-1, 12C-1, and 12D-1 -- illustrating -- **** - - I -- a crest -- ****** which a row of teeth and II show a concavo-convex key, and III shows the concavo-convex fylfot pattern, in addition gives various kinds of shape of toothing and patterns to the front face of material tubing by implementation of this invention is made.

[0029] Drawing 6 and drawing 7 show the more concrete structure of rodding with the rectangle cross section which can be used in the operation gestalt of drawing 4 (b). The 1st taper section 120-2 to which rodding 120 follows the interior [120-1] 120-1 of a proposal and a proposal at a tip, The 1st taper section 120-2 The 1st diameter expansion section 120-3 which follows, The taper section 120-4 which follows the 1st diameter expansion section 120-3, and the 2nd diameter expansion section 120-5 which follows the 2nd taper section 120-4, The 3rd taper section 120-6 which follows the 2nd diameter expansion section 120-5, and the 3rd diameter expansion section 120-7 which follows the 3rd taper section 120-6, It consists of the section 120-9 per [which follows the diameter reduction section 120-8 which follows the 3rd diameter expansion section 120-7, and the diameter reduction section 120-8, and is prolonged to near the root of a holder] buckling prevention.

[0030] Rodding is introduced into material tubing from the interior 120-2 of a proposal at the time of press fit of the rodding 120 to material tubing, and when the 1st diameter expansion section 120-3 engages with the inner circumference of material tubing through the 1st taper section 120-2, a flow of the meat of the material to the concave heights of metal mold inner circumference is caused. If press fit advances further, a metal flow of the same material will be caused by the taper section 120-4, 120-6 and the diameter expansion section 120-5, and 120-7. Since the diameter expansion section 120-3, 120-5, and 120-7 receive several times as much unit planar pressure as the compressive strength of a material during extended actuation, as for the material of rodding, it is desirable to receive phosphate treatment. Moreover, in order to cope with the oil film piece under actuation, it is suitable for the diameter expansion section 120-3, 120-5, and 120-7 on the front face to perform formation processings, such as a minimum labyrinth slot, a minimum minute crepe pattern, etc. which can serve as an oil pot. As for such an oil pot, it is desirable to prepare not only in the shaping section but in the field by the side of the confrontation which receives reaction force at the time of shaping. Or an oil pot may be prepared in the perimeter of the shaping section.

[0031] In drawing 6, by preparing the taper section 120-2 in which a path increases gradually, 120-4, 120-6 and the diameter expansion section 120-3, 120-5, and 120-7, a flow of the meat in one press fit can be performed one by one, can make [many] the amount of flow of the meat as total, and can raise productivity. In this case, there is a possibility of the containment of a lubricating oil becoming strong and putting the molding configuration by rolling out of order. The diameter reduction section 120-8 prepared behind the diameter expansion section 120-7 attains the function to prevent this, by missing the confined lubricating oil.

[0032] It will hit, if press fit of rodding is continued, and the section 120-9 fits into the inner circumference of material tubing densely, and attains the function to receive the load of the buckling direction which joins rodding. That is, at the root side of rodding which became more than the depth with press fit of rodding to material tubing, and passed over the diameter expansion section 120-3, 120-5, and 120-7, after it hit and the section 120-9 has fitted into material tubing in few clearances, rolling by the side of a tip is advanced. Therefore, in rolling formation of a long rack bar, it hits, and is the section 120-9. Stable support of a material is performed and reservation of the required endurance of rodding at the time of being able to give allowances to a buckling limit and making [many] the amount of metal flow at the time of one press fit can be aimed at.

[0033] Next, drawing 8 and drawing 9 explain the rack bar rolling equipment of the two or more rodding coincidence press fit and the multistage shift method as implementation of the rolling formation by the principle of this invention. In drawing 8 and drawing 9 , 30 is a bed for laying metal mold on it, and the metal mold 110 of the plurality (drawing three pieces) as a split mold of a horizontal aperture is arranged in piles in a longitudinal direction. Each metal mold 110 consists of two split molds 112 and 114, one split mold 112 has rack gear-tooth-like irregularity like drawing 2 , and the split mold 114 of another side forms the hemicycle slot for holding a tube-like material.
[0034] The pressurization cylinder 32 is formed in the 1 side in the direction of a list of the metal mold 110 on a bed 30, and the pressure receiving frame 34 is arranged at the side else. The pressurization cylinder 32 can be equipped with a piston 32-1, and where a piston 32-1 is pulled back, as shown in the upper half (from an alternate long and short dash line L to a top) of drawing 8 , it can form the space S to separate the split mold 112 of the horizontal division which constitutes it, and 114 (to also see the (**) of drawing 2), and for each metal mold 110 insert material tubing between them. If it moves forward for pressurization as the piston 32-1 of the pressurization cylinder 32 shows the lower half of drawing 8 by supply of oil pressure A bed 30 top is moved to a split mold 112 and 114 in a longitudinal direction, and fastening maintenance of the metal mold 110 by which the horizontal pile was carried out is carried out between a piston 32-1 and the pressure receiving frame 34. If the split mold 112 which constitutes each metal mold 110, and 114 are shown in (**) of drawing 2 , as it coalesces similarly and is shown in the lower half of drawing 8 , the material tubing 18 (a broken line shows) will be clamped between a split mold 112 and 114.
[0035] In the both sides of the direction of a horizontal pile of metal mold 110, and the direction which intersects perpendicularly, stacker 36A and 36B are arranged at the both-ends side of the direction of an axis of a split mold 112 and the material tubing 18 clamped by 114. Rodding holder 38 A-a by which left-hand side stacker 36A has been arranged in the vertical direction multistage as shown in drawing 9 , 38 A-b, and 38 A-c (although the number of a rodding holder is 3, it can make a required number of the other arbitration of rodding holders provide in illustration), These rodding holder 38 A-a, 38 A-b, and 38 A-c It consists of elevator style 42A to which vertical movement of rodding holder 38 A-a within stacker frame 40A held in the condition on which it can be vertical slid, and stacker frame 40A, 38 A-b, and 38 A-c is made to perform. Each of rodding holder 38 A-a, 38 A-b, and 38 A-c has removable structure in rodding 20A of the number of fixeds number of line at the one-touch type. Moreover, oil hydraulic cylinder 44A for press fit control is prepared in the outside of left-hand side rodding holder stacker 36A. Sequential engagement of piston 44A-1 of press fit control oil hydraulic cylinder 44A is carried out at rodding holder 38 A-a held at stacker 36A, 38 A-b, and 38 A-c. The selected rodding holder is moved to the left from the right of drawing, rodding held at the rodding holder is pressed fit towards the internal cavity of the material tubing 18 clamped by metal mold, and the irregularity of a ****** configuration is given to the irregularity formed in the external surface of material tubing at metal mold inner circumference as drawing 1 explained.
[0036] After press fit by two or more rodding 20A held at one rodding holder 38 A-a finishes Rodding holder 38 A-a retreats leftward to the part of stacker frame 40A. One case shift of rodding holders in stacker frame 40A is carried out in the vertical direction

(for example, above) by elevator style 42A. Rodding holder 38 A-c of the following order of processing is extruded rightward [of drawing 9] by piston 44A-1, rodding 20A' held at rodding holder 38 A-c is pressed fit in the interior cavity of shaft orientations of the material tubing 18, and rolling actuation of the next phase is carried out.

[0037] Rodding holder 38 B-a which that of the structure of stacker 36B arranged on the right-hand side of the metal mold bed 30 in drawing 9 is the same as that of left-hand side it, and has been arranged in the vertical direction multistage, 38 B-b, and 38 B-c, Rodding holder 38 B-a, 38 B-b, and 38 B-c It consists of elevator style 42B to which rise and fall of rodding holder 38 B-a within stacker frame 40B held free [vertical sliding] and stacker frame 40B, 38 B-b, and 38 B-c are made to perform. Moreover, oil hydraulic cylinder 44B for press fit control is prepared in the outside of right-hand side rodding holder stacker 36B. Sequential engagement of piston 44B-1 of press fit control oil hydraulic cylinder 44B is carried out at rodding holder 38 B-a held at stacker 36B, 38 B-b, and 38 B-c. The selected rodding holder is moved to the left from the right of drawing, rodding held at the rodding holder is pressed fit towards the internal cavity of the material tubing 18 clamped by metal mold 110, and the irregularity of a ****** configuration is given to the irregularity formed in the external surface of material tubing at metal mold inner circumference as drawing 1 explained. Moreover, one step of rodding holder in stacker frame 40B is shifted at a time in the vertical direction by elevator style 42B.

[0038] Although the shift of a rodding holder on either side is performed in linkage according to advance of a press fit phase, in each phase, rodding on either side is pressed fit in the material tubing 18 by turns, as explained in relation to drawing 1 . Namely, the 2nd-step rolling actuation is carried out in drawing 9 . Rodding 20A to which rodding 20A held at left-hand side rodding holder 38 A-b was moved rightward by piston 44A-1 of a press fit cylinder is pressed fit in each material tubing 18 clamped by each metal mold 110 of a horizontal pile all at once. Rodding 20A held at rodding holder 38 A-b after the press fit finished is pulled back by left-hand side. Rodding 20B which was made to carry out a lap to the pull back, and was held at right-hand side rodding holder 38 B-b of the 2nd step is moved leftward [of drawing 9] by piston 44B-1 of press fit cylinder 44B, and rodding 20B is pressed fit in each material tubing 18 clamped by the metal mold 110 of a horizontal pile all at once. And press fit of right and left of such rodding holder 38 A-b and 38 B-b is similarly carried out repeatedly two or more times with having explained in relation to drawing 1 . this -- a stage -- rolling -- actuation -- completing -- if -- left-hand side -- a stacker -- and -- right-hand side -- a stacker -- a shift -- predetermined -- a direction -- for example, -- above -- carrying out -- having -- a degree -- a stage -- a sake -- rodding -- a holder -- 38 -- A-c -- 38 -- B-c -- holding -- having had -- rodding -- 20 -- A -- ' -- 20 -- B -- ' -- two or more -- a ** -- coincidence -- right and left -- alternation -- a material -- tubing -- pressing fit -- having -- this -- a phase -- rolling -- actuation -- carrying out -- having .

[0039] It sets to drawing 8 and the rolling method of 10, and each is made to carry out coalesce maintenance of the split mold 112 which constitutes each metal mold, and 114, when the horizontal pile of two or more horizontally divided metal mold 110 is carried out and it pressurizes from both sides. When rodding is pressed fit to material tubing held at metal mold, with rodding insertion pressure, overturning moment M received on a bed 30 puts welding pressure P on the distance L from a bed to the core of metal mold, metal mold serves as M=LxP, but since two or more metal mold is made into the horizontal pile,

the value of an overturning moment has the advantage which becomes completely the same as that of the case where the number of metal mold is one.
[0040] Moreover, by the denial of the reaction force between contiguity metal mold, the holding power at the time of piling up two or more metal mold in the pressurization direction (longitudinal direction) about the welding pressure by the oil hydraulic cylinder 32 which holds the metal mold 110 at the time of rodding press fit in the closing condition is the same as that of the welding pressure holding the metal mold of a piece, and does not need to adopt a thing large-sized as an oil hydraulic cylinder 32 for two or morecarat mold.
[0041] In the operation gestalt of this invention, although the migration direction of core bar 20A and 20B and the migration direction of metal mold 110 are in a horizontal plane, as shown in drawing 8 , tolerance is mutually carried out to the shape of a cross joint. Therefore, as shown in drawing 9 , the upper part of metal mold 110 forms the space opened wide altogether substantially. Therefore, a loader 111 can perform loading to the metal mold 110 of new material tubing 18' which is a work piece, and drawing of a product in the vertical direction like an arrow head b1 and b2. Moreover, since the upper space of metal mold has opened wide completely, it is effective in the maintenance becoming easy. Moreover, since it has the structure where stacker frame 40A for core bar holder 38 A-a, 38 A-b, 38 A-c, 38 B-a, 38 B-b, and 38 B-c and 40B can also be opened wide up, the maintenance can also be easy-ized.
[0042] the split mold 112 with which drawing 10 and drawing 11 constitute each metal mold 110, and the cleaning liquid injection nozzle in 114 -- it bites and the work-piece kick out is shown. That is, the shower ring of a lot of coolant is needed for superfluous are recording of generation of heat of plastic working by continuous molding. Moreover, it is necessary to inject a penetrant remover powerfully at coincidence to a concavo-convex rolling metal mold side and the clamp side of the opposite side at the time of metal mold opening of the work-piece ejection working-level month at the time of the continuous-molding termination after one clamp, to exclude the dust of the dregs and others for phosphate coating processing each time, and to maintain the purity of metal mold, and it necessary to prevent generating of a blemish. For that purpose, it is desirable to plan so that fall distance of a penetrant remover and a bed side may be shortened and quick washout may be performed. That is, an injection nozzle 112-1 and 114-1 are carrying out opening to the split mold 112 and the shaping side of 114, when a split mold can open after rolling, cleaning liquid is injected towards the other party's split mold from an injection nozzle 112-1 and 114-1, and cleaning and cooling can be performed. Moreover, it bites, and a work-piece kick out can be constituted by a pin 112-2 and 114-2, and can project now a pin 112-2 and the work piece bit to the inside of a mold by ejection actuation of 114-2. Blemish generating prevention of one clamp can be brought about by this structure adoption.
[0043] Drawing 12 and drawing 13 show an example of the concrete supporting structure of the cylinder for rodding press fit. Since drawing 12 and drawing 13 are brief, although only the oil hydraulic cylinder 44 for the rodding press fit on the right-hand side of metal mold 110 is shown, the oil hydraulic cylinder same also on the left-hand side of the ****** metal mold 11 as drawing 9 is prepared. 130 is oil hydraulic cylinder susceptor and the cross-section horseshoe-shaped housing 132 is attached on the oil hydraulic cylinder susceptor 130. From the inside of the surface of a housing 132, suspension

formation of the reverse bending rib 134 which set spacing of a pair is carried out at the shape of a cantilever. The body of an oil hydraulic cylinder 44 is fixed to the reverse bending rib 134. From an oil hydraulic cylinder 44, a piston rod 44-1 is prolonged, the rodding holder 38 attaches at the tip of a piston rod 44-1, and rodding 20 is held at an eclipse and the rodding holder 38. If a piston rod 44-1 develops, the rodding 20 held at the rodding holder 38 and the rodding holder 38 at a tip of a piston rod 44-1 will develop, it will be pressed fit in the material tubing 18 held at the metal mold 110 on a mold 110, and encaustic attachment will be performed on the front face on which flattening of the material tubing 18 was carried out.

[0044] If an operation of drawing 12 and the reverse bending rib 134 of drawing 13 is explained, an oil hydraulic cylinder 44 will be cantilever installation, and a housing 132 will bend upward with the stress at the time of press fit of the rodding 20 to the material tubing 18. Supposing it remains this bending of a housing 132 as it is, namely, has formed the direct oil hydraulic cylinder 44 in the housing 132, the pressurization axial center of rodding 20 can be shifted upward, and it will become the cause of the life-shortening of rodding 20. On the other hand, with drawing 12 and the operation gestalt of drawing 13 , the oil hydraulic cylinder 44 is installed in the reverse bending rib 134 by which cantilever installation is carried out from the upper part plate of a housing 132. The bending direction of the reverse bending rib by the stress at the time of press fit of the rodding 20 to the material tubing 18 is downward [opposite to the bending direction of a housing 132]. Therefore, since it becomes small or it can offset upward bending of a housing 132 by downward bending of the reverse bending rib 134 and a gap of the pressurization axial center of rodding 20 does not arise by designing the reverse bending rib 134 appropriately, it is effective in the life of rodding 20 being extensible.

[0045] the case where a thing high as process tolerance is not needed if the split mold 112 which constitutes the metal mold 110 used for the equipment of drawing 8 and drawing 9 , and the configuration of 114 are explained, and a configuration -- processing -- an easy thing can constitute the concavo-convex die itself as a clamp mold, as already explained in relation to drawing 2 . However, it is necessary to require precision, to carry out independent processing of the concavo-convex shaping section itself about what has the high difficulty of configuration processing, and to consider as the configuration which laid the mold under the clamp split mold. In this case, let a clamp split mold be a split mold holder. In this case, the powerful mold injection nozzle of the penetrant remover for blemish generating prevention is embedded from a viewpoint of installation by the minimum distance at this split mold clamp. Moreover, if a work piece should bite, there is a possibility of causing breakage of work-piece ejection equipment. Therefore, it is desirable to build the compulsive ejection equipment of a work piece into a clamp mold. Moreover, if dispersion is in opening of a work piece, since the gas supply pressure failure of a work piece will be invited and it will become the factor of productivity inhibition, it is desirable to incorporate equipments, such as injection nozzle work-piece knockout-die opening dimension regulation for eliminating this.

[0046] Next, the case where do not stage-picking-change the product of two or more forms, and it is processed with the equipment of the multistage shift expression of a rodding holder is explained. First, if the number of rodding held at a rodding holder is explained, odd number is desirable, the number of rodding is 3 in drawing 8 , and you may make it hold five rodding to rodding holder 38A and 38B like drawing 14 ,

respectively. If in charge of coincidence shaping of a different form, even if it is the case where various kinds of formation insertion pressure differs, it is necessary to make it the eccentric load to a rodding press fit cylinder not occur. In drawing 14 , coincidence processing of three forms of A, B, and C is performed, the case where the volume is A<B<C is assumed, and if B is processed on the both sides and C is processed for A with few production numbers at the core in the outermost part, balance can be maintained. Moreover, naturally shaping by one rodding shall be of use for the form with few volumes. moreover -- the case where full equipment of the five rodding A, B, and C is carried out at a rodding holder -- A sorts -- production -- if the material tubing 18 for A sorts is not supplied to metal mold 110 as shown in drawing 14 when it becomes unnecessary, it can come out as it is, without carrying out desorption of the rodding in the rodding clamp mold for A sorts, and processing can be continued.

[0047] Next, the case where do not stage-picking-change the product of two or more forms, and it is processed with the equipment of the multistage shift expression of the rodding holder shown in drawing 8 and drawing 9 is explained. If the case where the product of A sequence manufactured at six processes and the product of B sequence manufactured at ten processes are manufactured with the machine which equipped right and left with eight steps of stackers is mentioned as an example, in A sequence, three steps of stacker tops on either side and B sequence will use five steps of stacker bottoms on either side. The product of A sequence can be manufactured because start from an upper case and 6 ** perform drawing of rodding from a stacker, press fit of rodding, and pull back more nearly alternately with right and left. Moreover, total 10 process is carried out by carrying out alternately with right and left about the stacker of five steps of bottoms, and B sequence can be acquired for a product. Moreover, by using it four steps of upper and lower sides at a time on either side about Sequences C and D, it stage-picking-changes, and in the case of the sequences C and D which can be manufactured at eight processes, respectively, it is nothing, and it can be cleared up.

[0048] drawing 15 shows various kinds of example a-r of combination which stepless-picking-changes, comes out and performs coincidence processing of varieties. O**** shows the gestalt of processed material tubing symbolically. (b) of drawing 15 shows the combination at the time of coincidence processing by one rodding holder 38A and 38B, and as explained in drawing 14 in this case, symmetry arrangement of the odd core bar is carried out so that an eccentric load may not arise. (**) of drawing 15 shows the combination in the shift direction (the vertical direction) in stacker 36A on either side and 36B, and adopts a suitable combination according to the combination of the form to produce. That is, a, g, and m are the cases where there is only an order of only the item of O, **, and **. What is necessary is just to lessen metal mold which sets material tubing, if there are few orders. O And if there may be an order of **, it will become the combination of Examples b and h and the number of sets of material tubing will be adjusted according to the number of orders of O and **. therefore, arrangement of rodding and metal mold is left as it is, and required in a required form, if it changes stage picking and puts in another way nothing -- number production can be carried out. O When three forms of ** and ** need to be produced, according to the ratio of that burst size, Examples c, d, e, f, i, j, k, l, and n, **, p, q, r, etc. are chosen, and also in this case, coincidence processing of three forms can be changed stage picking, and can be performed nothing.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] the base of a trigonum with the cavity of shaft orientations in this invention, a rectangular head, multiple, an anomaly, and which circular cross-section configurations of various kinds of -- a part of type material or the whole front face -- concavo-convex processing of the gestalt of the deep arbitration of a lump [carve] -- a high precision -- and, if an example is given about the straight-line drive type shaping equipment formed efficiently Although it is applicable to manufacture of the rack bar which are the steering components of an automobile, it is applicable to this invention giving the desired shape of surface toothing and a desired pattern not only to manufacture of a rack bar but to various kinds of machine functional part and ornament components.

[Translation done.]

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PRIOR ART

[Description of the Prior Art] The technique which fabricates the rack bar which are the steering components of an automobile by rolling from ****** type material is theoretically well-known. That is, in rolling shaping of a rack bar, flattening of the rack forming face of a hollow rod is performed by covering a press, holding first the ****** type material softened with heating with a mold. Next, rodding is pressed fit in the cavity

of a hollow rod from an outside, applying a die with the row of teeth of the direction of a straight line to inner circumference at said flat part of a hollow rod. Rodding has the taper-like operation section, when the taper section engages with a flat part at an inner circumference side, the meat of a flat part is jutted out by flowing in plastic deformation towards a die, and the row of teeth of the direction of a straight line of a ****** configuration is given to a flat part at the row of teeth of a die. Only by one press fit of the core bar, since the product of an expected precision is not obtained, processing it, while the diameter of an operation arranges the core bar which carried out sequential change in a turret mold and makes a sequential change of the diameter of an operation of the core bar is proposed.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In the thing of a turret mold, the turret from which the diameter of an operation changes for every split mold is required, the product obtained by one press fit actuation is only a piece, and it got worse to the degree of pole as productive efficiency, and since the merit of the rack bar manufacture by forging was hardly able to be employed efficiently, practical use was hardly presented with the thing of a turret mold until now. This invention is made in view of this trouble, it cancels the fault of a turret mold, it does not have a cutting article and inferiority in precision while it realizes coincidence manufacture of two or more products by enabling simultaneous press fit of two or more core bar, and it aims at enabling it to press down in cost and cheaply moreover.

[0004] Two or more split molds of the horizontal division which is arranged in piles in a longitudinal direction according to invention according to claim 1, pressurizing so that it may insert into the bed for laying a split mold, and the split mold arranged in piles in a longitudinal direction from the both sides of opposite Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne. -- the base of the variant cross section of the shape of two or more straight line -- type material to each split mold with the pressurization means which carries out pressurization maintenance It has a rodding press fit means for pressing fit all at once towards the cavity of the shaft orientations of type material. each base held at each split mold in two or more rodding held by the rodding holder which estranges two or more rodding in parallel with a longitudinal direction, and holds it, and the rodding holder -- base -- the base by press fit of rodding to type material -- the base of plurality

[formation / of the configuration according to the irregularity of the metal mold inner circumference to the periphery of type material] -- the straight-line drive type shaping rolling equipment characterized by being carried out at once about type material is offered.

[0005] two or more rodding by which the welding pressure according [if an operation and effectiveness of invention of claim 1 are explained, as for the split mold of longitudinal direction division, plurality will be arranged at a horizontal pile, and] to the pressurization means from both sides to the split mold of a horizontal pile was held with the holder in addition ** and where each ** type material is clamped with each split mold -- each base -- the cavity of type material -- it is pressed fit all at once and rolling of each ** type material is performed to coincidence. At this time, the overturning moment which joins a bed from a split mold by rodding press fit becomes being the same as that of the case where the number of split molds is one. Although the pressurization means which was in agreement with the number of sets of a split mold is needed when a split mold tends to be made into vertical division and it is going to clamp this up and down all at once as lining up side-by-side, and the clamp force becomes huge and each split mold is clamp use separately In this invention, by making a horizontally divided split mold into a horizontal pile, and clamping from lateral both sides, a pressurization means can be substituted for a piece, without completely increasing the clamp force, and very [in cost] advantageous effectiveness can be acquired.

[0006] Two or more split molds lining up side-by-side and arranged according to invention according to claim 2, pressurizing each split mold in the direction of mold doubling -- the base of a variant straight-line-like cross section -- with a pressurization means to make type material hold, respectively The stacker for holding two or more rodding holders estranged in parallel in the shape of a pile according to the order of two or more processes, A means to return a used holder to a rodding holder while taking out one holder of the arbitration of the rodding holders held in the shape of a pile at the stacker from a stacker, It has the rodding press fit and the pull back means for pressing fit all at once and pulling back towards the cavity of the shaft orientations of type material. the base which was held by the one rodding holder and held at the split mold of correspondence by rodding -- A rodding holder is taken out from a stacker according to the order of a process every [1] from two or more rodding holders accumulated on the stacker, and the straight-line drive type shaping rolling equipment characterized by being carried out to a multistage story by rodding from which press fit of rodding to each ** type material differed is offered.

[0007] if an operation and effectiveness of invention of claim 2 are explained -- a rodding holder -- rodding of the processing stage -- several -- collecting -- it should become -- it is held free [attachment and detachment] by one-touch, and the rodding holder of each processing stage is set to a stacker in the shape of a pile according to processing sequence. It is pressed fit in type material all at once. the base of the correspondence clamped by the split mold with rodding lining up side-by-side which the rodding holder was taken out from the stacker according to processing sequence, and was held at the rodding holder -- Rodding is drawn out after termination of a press fit process. After several repetitions of press fit and pull back The rodding holder which ** was also re-contained by the stacker and held rodding of the following order of processing by actuation of a shift of a stacker etc. is taken out for a rodding holder from a stacker, and rodding is the receipt to the press

fit-********** stacker of rodding like the following. - The ejection of the rodding holder of the next phase is repeated. It is effective in the ability to carry out multistage story rolling actuation very efficiently by this configuration.

[0008] According to invention according to claim 3, in invention of a publication, the space wide opened outside above metal mold is formed in claim 1 or 2, and the straight-line drive type shaping rolling equipment characterized by installing the loader for insertion of the material to metal mold and taking out of a product in this space is offered.

[0009] If an operation and effectiveness of invention of claim 3 are explained, since insertion of a material and taking out of a product can be performed from the upper part of the metal mold wide opened with the loader, effective use of space is realized and the whole equipment is made into a compact.

[0010] According to invention according to claim 4, in invention according to claim 3, a stacker is installed in the both sides of a split mold, and the straight-line drive type shaping rolling equipment characterized by every one thing [holders / two or more / which were accumulated on the stacker / rodding] performed on a multistage story by rodding from which the rodding holder was taken out from the stacker of both sides by turns according to the order of a process, and press fit of rodding to each ** type material differed is offered.

[0011] if an operation and effectiveness of invention of claim 4 are explained, since a rodding holder will be taken out from a stacker on either side one by one according to the order of a process and rodding of the taken-out rodding holder will be pressed fit alternately with right and left -- the rolling of the deep concavo-convex pattern on the front face of a thin wall tube -- precision -- there is effectiveness which can be carried out highly.

[0012] According to invention of claim 5, in invention according to claim 4, the straight-line drive type shaping rolling equipment characterized by driving to the timing that the both-way drive for rodding in the rodding holder from one near stacker and the both-way drive of rodding in the rodding holder from the stacker of the opposite side are independent is offered.

[0013] If an operation and effectiveness of invention of claim 5 are explained, it is realizable that selection of the drive timing of right-and-left independence raises the compatibility over a limited-production-with-a-wide-variety system, changes a product which is different with one set of a machine stage picking, and produces it by the minimum nothing or paragraph ****.

[0014] pressurizing a split mold and a split mold in the direction of mold doubling according to invention according to claim 6 -- the base of a variant straight-line-like cross section -- with a pressurization means to make type material hold the base held in rodding at the split mold -- it has an oil hydraulic cylinder means for pressing fit and pulling back towards the cavity of the shaft orientations of type material, and the straight-line drive type shaping rolling equipment characterized by attaching this oil hydraulic cylinder means in the reverse bending rib for bending include-angle offset is offered.

[0015] If an operation and effectiveness of invention of claim 6 are explained, in implementation of this invention, the clamp direction of a split mold and the press fit direction of rodding will tend to serve as arrangement which intersects perpendicularly X and in the shape of [of Y] a cross joint. In this cross-joint arrangement, since it is maintenance of workability that the pressurization means of a Y-axis also prepares a

stanchion in the middle, the pressurization means of the X-axis is also difficult, and it becomes a cantilevered suspension. In this case, opening of the protrusion jaw by stress distortion occurs structurally, and it is easy to produce a gap in a pressurization axial center. This gap has a possibility of shortening the life of rodding. On the other hand, in the 7th invention, by not preparing a direct cylinder in the jaw of a pressurizer, but adding the reverse bending rib for bending include-angle offset, and preparing a cylinder in this, distortion of an opposite direction can arise mutually between a jaw and a rib, and distortion can be negated, or it can be made small, and a gap of an axial center can be made into prevention or min.

[0016]

[Embodiment of the Invention] Drawing 1 and drawing 2 show roughly rolling formation of the hollow rack which are the steering components of the car from the metal tube as 1 operation gestalt of this invention. The metal mold 10 as a split mold consists of a punch 12 and female mold 14, and shows the cross section of drawing 2 and metal mold 10 in the state of closing in an open condition and (b) in (b). The punch 12 has the rack gear-tooth-like tooth part 12-1 in the die-length direction crevice in the inner skin which faced female mold 14, and, on the other hand, female mold 14 forms the die-length direction slot 14-1 of a cross-section semicircle arc in the top face facing a punch 12. (b) of drawing 2 shows the condition that the tube 18 was already laid in the cross-section semicircle arc die-length direction slot 14-1 of female mold 14.

[0017] the variant base in which the upper half 18-1 where a tube 18 faces a punch 12 is crushed evenly, and should receive the shaping rolling of a rack gear tooth if metal mold 10 is closed like (b) of drawing 2 by moving a punch 12 and female mold 14 in the direction which faces mutually from the condition of (b) of drawing 2 -- it becomes type material. Drawing 1 shows the die-length direction sectional view of the metal mold 10 in the closing condition shown in (b) of drawing 2 . Metal mold 10 has only about 1 / two or less die length of the material tubing 18 of a circular cross section. And although the ends of a tube 18 are metal mold 10 and a field 1, the opposite end is projected one half of more than die length. However, if it has stopped to the front a little from the end face of metal mold 10, crushing of left end 18A and right end 18B of the material tubing 18 is not evenly carried out in the closing condition of metal mold 10 but the tooth part 12-1 formed in the inferior surface of tongue of a punch 12 facing female mold 14 is put in another way, both-ends 18A of the material tubing 18 and 18B have stopped with the circular cross section.

[0018] flattening [of the top face which is a rack forming face of the material tubing 18 with the operation gestalt of this invention explained to drawing 1 and drawing 2] = -- formation of ****** type material -- rack rolling formation -- public funds -- closing of a mold 10, i.e., the coalesce with a punch 12 and female mold 14, is performing. That is, since the rack-like tooth part 12-1 of a punch 12 comes to the place whose distance from the base of female mold 14 is the one half strength of the outer diameter of the material tubing 18 at the time of metal mold closing, the material tubing 18 is evenly crushed, as the rack-like tooth part 12-1 of a punch 12 shows to (b) of drawing 2 . Therefore, the sequential shift of the metal mold 10 can be carried out continuously as it is at the following process, without carrying out a mold aperture. Thereby, while being able to carry out [lap]-izing of the process, since clamp actuation can be made only into 1 time of the beginning, there is an advantage which can lose the opportunity of generating of

the blemish by the clamp. Moreover, since the mold for rolling was used for anomaly-izing, the precision of anomaly-izing had a fall as compared with the case where the original mold only for anomaly-izing is used, but unless the precision prescribe was very high, it actually turned out that there is no upper problem. It is more as possible as a taking-usual process which crushes top face of tube with mold of dedication for flattening, and carries out mold aperture after that and which is clamped to metal mold for rolling peach.

[0019] In drawing 1, a split mold 12 and the material tubing 18 after cross-section flattening held among 14 receive the rolling process of this invention by press fit and pull back of rodding. Hereafter, if this is explained, when clamped by metal mold 10, rodding 20A and 20B will counter shaft orientations, and will be arranged at the both sides of ******** 18 to which flattening of the top face was carried out. Rodding 20A and 20B have the ****** cross-section configuration in the cross-section configuration of the part of the material tubing 18 by which cross-section flattening was carried out as the cross-section configuration was shown in (b) of drawing 2 . As shown in drawing 1 , the tip of rodding 20A and 20B is making the interior 20-1 of a proposal, and serves as a guide of installation into the part of the material tubing 18 by which cross-section flattening was carried out. Back inside [20-1] a proposal, the diameter expansion section 20-3 continues via the taper section 20-2. When the taper section 20-2 engages with the flat part 18-1 of the material tubing 18 at the time of press fit of rodding 20A and 20B, from inside, turn the meat of material tubing outside at the irregularity of the rack dentate part 12-1 of metal mold, and it carries out a metal flow. The allocated type of the rack-like tooth part complementary in the shape of [the] toothing is carried out to the flat part 18-1 of material tubing. In drawing 1 , rodding 20A and 20B follow the 1st diameter expansion section 20-3, the 2nd diameter expansion section 20-5 continues through the taper section 20-4, and a metal flow of the sequential multistage story by one rodding is obtained.

[0020] The first condition pressed fit in the material tubing 18 to the extent that flattening of the left-hand side rodding 20A was carried out as the 1st process in drawing 1 is shown. It is moved towards left-hand side a line crack and after that until extraction of the rodding 20A is carried out completely and it results from the material tubing 18, until, as for press fit of left-hand side rodding 20A, the last diameter expansion section 20-5 reaches at the right end of the flat part 18-1 of material tubing.

[0021] With the timing difference of the extraction of left-hand side rodding 20A, and suitable wrapping, right-hand side rodding 20B starts migration on the left-hand side of drawing 1 , and the process of the same metal flow as that with which right-hand side rodding 20B came to be introduced into the internal cavity of the material tubing 18, and explained left-hand side rodding 20A to be by the diameter expansion section is caused.

[0022] The press fit-extraction of left-hand side rodding 20B continued to the press fit-extraction of right-hand side rodding 20A and this is repeated several times. That is, press fit of rodding 20A of the right and left to the material tubing 18 and 20B is repeated two or more times by turns. A positive flow of meat to the crevice of metal mold can be urged to repeat-press fit of each rodding 20A to the internal cavity of the material tubing 18, and 20B. That is, although just one press fit of rodding of the flow of meat is insufficient and there is a possibility that rolling with a high precision cannot carry out, such fear is avoidable with repeat-press fit. Moreover, an equal metal flow to the crevice of metal

mold can be obtained by mutual press fit of the multiple times of rodding 20A on either side and 20B, and it is effective in rolling with a high precision being realizable. That is, drawing 3 expresses typically the flow condition of the meat grasped from the stratification condition of the tooth part in the cross-section microphotography of the tooth part of the actual rack obtained by rolling. It turns out that the flow condition of the meat of this invention that performs mutual press fit as shown in an arrow head f1 is expressed with (b), and the symmetrical flow condition is acquired. On the other hand, it turns out that accept and come out, the flow condition in a certain case is shown, and deviation is in a flow of meat in this case, and contamination has occurred while [whose press fit direction of rodding is / like / (b) / an arrow head f2]. The uneven flow condition of such meat makes the return of the elastic strain accompanying the uneven stress residual and this uneven after the completion of shaping of a rack gear tooth, i.e., the ununiformity of the amount of springbacks, cause, and although it becomes the cause of a precision fall of a product, since a flow of equal meat is secured in this invention, such a trouble is canceled.

[0023] Again, if the shift of the vertical direction of rodding is explained in drawing 1 , two or more pairs which consist of rodding 20A on either side and 20B are prepared up and down. drawing 1 -- the pair of rodding 20A and 20B -- although the pair of another rodding 20A' and 20B' is shown caudad, the rodding pair of a required number of stages is arranged in the vertical direction. The configuration of rodding, such as a diameter of an operation, is changing gradually in the shift direction so that processing may progress a phase to ** of a shift later on. Two or more steps of rodding pairs are loaded into the stacker on either side which is not shown in drawing 1 , and processing is performed, shifting a stacker. Namely, after performing the 1st-step processing by pressing the rodding 20A and 20B of the first processing stage fit by turns, The rodding holder in a stacker on either side is shifted upward like an arrow head a at the time of standby. Rodding 20A' of the 2nd step and 20B' are made to align by the material tubing 18, it is made to press rodding 20A' and 20B' fit in the internal cavity of the material tubing 18 by turns, the 2nd-step processing is carried out, and processing of a need number of stages is carried out like the following. thus, the thing for which rodding is changed little by little and much processings are performed over a stage -- material tubing of closing in -- also receiving -- the allocated type of the shape of deep toothing -- precision -- there is highly realizable effectiveness.

[0024] (b) of drawing 4 - (d) explain the rate structure of the metal mold for endowing the shape of toothing with various kinds of ****** type material and it which can carry out this invention. (b) of drawing 4 shows material 18A which carried out flattening of the upper half of the tube explained in relation to drawing 1 and 2. Metal mold consists of punch 12A and female mold 14A, punch 12A faces the flat part of material 18A, and has concave heights 12A-1, and the shape of complementary toothing is formed in the flat side of material 18A of press fit of rodding at this irregularity.

[0025] (b) of drawing 4 shows material 18B of a rectangle cross section, and material 18B is clamped between punch 12B and female mold 14B. Punch 12B faces one side face of material 18B, and has concave heights 12B-1, and irregularity complementary to this irregularity is formed in one side face of material 18B of press fit of rodding.

[0026] Three are carried out comparatively. (Ha) of drawing 4 shows material tubing 18C of 6 square-shape cross section, and metal mold consists of 12C, 12C', and 14C -- They

are concavo-convex 12C-1 and 12C' to the inside of each split mold 12C, 12C', and 14C. - 1 and 14C-1 are formed and irregularity complementary to this irregularity can be formed in the side face in every other one of 6 angle cross-section material tubing 18B by press fit of rodding.

[0027] (d) of drawing 4 shows material tubing 18D of 3 square-shape cross section, it consists of punch 12D and female mold 14D, concavo-convex 12D-1 is formed in the inside of punch 12D, and metal mold can form irregularity complementary to this irregularity in the top face of 3 angle cross-section material tubing 18D by press fit of rodding.

[0028] material tubing of drawing 5 is flat -- surface 12A-1 and 12 -- various kinds of variations of the shape of toothing given to B-1, 12C-1, and 12D-1 -- illustrating -- **** - - I -- a crest -- ****** which a row of teeth and II show a concavo-convex key, and III shows the concavo-convex fylfot pattern, in addition gives various kinds of shape of toothing and patterns to the front face of material tubing by implementation of this invention is made.

[0029] Drawing 6 and drawing 7 show the more concrete structure of rodding with the rectangle cross section which can be used in the operation gestalt of drawing 4 (b). The 1st taper section 120-2 to which rodding 120 follows the interior [120-1] 120-1 of a proposal and a proposal at a tip, The 1st taper section 120-2 The 1st diameter expansion section 120-3 which follows, The taper section 120-4 which follows the 1st diameter expansion section 120-3, and the 2nd diameter expansion section 120-5 which follows the 2nd taper section 120-4, The 3rd taper section 120-6 which follows the 2nd diameter expansion section 120-5, and the 3rd diameter expansion section 120-7 which follows the 3rd taper section 120-6, It consists of the section 120-9 per [which follows the diameter reduction section 120-8 which follows the 3rd diameter expansion section 120-7, and the diameter reduction section 120-8, and is prolonged to near the root of a holder] buckling prevention.

[0030] Rodding is introduced into material tubing from the interior 120-2 of a proposal at the time of press fit of the rodding 120 to material tubing, and when the 1st diameter expansion section 120-3 engages with the inner circumference of material tubing through the 1st taper section 120-2, a flow of the meat of the material to the concave heights of metal mold inner circumference is caused. If press fit advances further, a metal flow of the same material will be caused by the taper section 120-4, 120-6 and the diameter expansion section 120-5, and 120-7. Since the diameter expansion section 120-3, 120-5, and 120-7 receive several times as much unit planar pressure as the compressive strength of a material during extended actuation, as for the material of rodding, it is desirable to receive phosphate treatment. Moreover, in order to cope with the oil film piece under actuation, it is suitable for the diameter expansion section 120-3, 120-5, and 120-7 on the front face to perform formation processings, such as a minimum labyrinth slot, a minimum minute crepe pattern, etc. which can serve as an oil pot. As for such an oil pot, it is desirable to prepare not only in the shaping section but in the field by the side of the confrontation which receives reaction force at the time of shaping. Or an oil pot may be prepared in the perimeter of the shaping section.

[0031] In drawing 6, by preparing the taper section 120-2 in which a path increases gradually, 120-4, 120-6 and the diameter expansion section 120-3, 120-5, and 120-7, a flow of the meat in one press fit can be performed one by one, can make [many] the

amount of flow of the meat as total, and can raise productivity. In this case, there is a possibility of the containment of a lubricating oil becoming strong and putting the molding configuration by rolling out of order. The diameter reduction section 120-8 prepared behind the diameter expansion section 120-7 attains the function to prevent this, by missing the confined lubricating oil.

[0032] It will hit, if press fit of rodding is continued, and the section 120-9 fits into the inner circumference of material tubing densely, and attains the function to receive the load of the buckling direction which joins rodding. That is, at the root side of rodding which became more than the depth with press fit of rodding to material tubing, and passed over the diameter expansion section 120-3, 120-5, and 120-7, after it hit and the section 120-9 has fitted into material tubing in few clearances, rolling by the side of a tip is advanced. Therefore, in rolling formation of a long rack bar, it hits, and is the section 120-9. Stable support of a material is performed and reservation of the required endurance of rodding at the time of being able to give allowances to a buckling limit and making [many] the amount of metal flow at the time of one press fit can be aimed at.

[0033] Next, drawing 8 and drawing 9 explain the rack bar rolling equipment of the two or more rodding coincidence press fit and the multistage shift method as implementation of the rolling formation by the principle of this invention. In drawing 8 and drawing 9 , 30 is a bed for laying metal mold on it, and the metal mold 110 of the plurality (drawing three pieces) as a split mold of a horizontal aperture is arranged in piles in a longitudinal direction. Each metal mold 110 consists of two split molds 112 and 114, one split mold 112 has rack gear-tooth-like irregularity like drawing 2 , and the split mold 114 of another side forms the hemicycle slot for holding a tube-like material.

[0034] The pressurization cylinder 32 is formed in the 1 side in the direction of a list of the metal mold 110 on a bed 30, and the pressure receiving frame 34 is arranged at the side else. The pressurization cylinder 32 can be equipped with a piston 32-1, and where a piston 32-1 is pulled back, as shown in the upper half (from an alternate long and short dash line L to a top) of drawing 8 , it can form the space S to separate the split mold 112 of the horizontal division which constitutes it, and 114 (to also see the (**) of drawing 2), and for each metal mold 110 insert material tubing between them. If it moves forward for pressurization as the piston 32-1 of the pressurization cylinder 32 shows the lower half of drawing 8 by supply of oil pressure A bed 30 top is moved to a split mold 112 and 114 in a longitudinal direction, and fastening maintenance of the metal mold 110 by which the horizontal pile was carried out is carried out between a piston 32-1 and the pressure receiving frame 34. If the split mold 112 which constitutes each metal mold 110, and 114 are shown in (**) of drawing 2 , as it coalesces similarly and is shown in the lower half of drawing 8 , the material tubing 18 (a broken line shows) will be clamped between a split mold 112 and 114.

[0035] In the both sides of the direction of a horizontal pile of metal mold 110, and the direction which intersects perpendicularly, stacker 36A and 36B are arranged at the both-ends side of the direction of an axis of a split mold 112 and the material tubing 18 clamped by 114. Rodding holder 38 A-a by which left-hand side stacker 36A has been arranged in the vertical direction multistage as shown in drawing 9 , 38 A-b, and 38 A-c (although the number of a rodding holder is 3, it can make a required number of the other arbitration of rodding holders provide in illustration), These rodding holder 38 A-a, 38 A-b, and 38 A-c It consists of elevator style 42A to which vertical movement of rodding

holder 38 A-a within stacker frame 40A held in the condition on which it can be vertical slid, and stacker frame 40A, 38 A-b, and 38 A-c is made to perform. Each of rodding holder 38 A-a, 38 A-b, and 38 A-c has removable structure in rodding 20A of the number of fixeds number of line at the one-touch type. Moreover, oil hydraulic cylinder 44A for press fit control is prepared in the outside of left-hand side rodding holder stacker 36A. Sequential engagement of piston 44A-1 of press fit control oil hydraulic cylinder 44A is carried out at rodding holder 38 A-a held at stacker 36A, 38 A-b, and 38 A-c. The selected rodding holder is moved to the left from the right of drawing, rodding held at the rodding holder is pressed fit towards the internal cavity of the material tubing 18 clamped by metal mold, and the irregularity of a ****** configuration is given to the irregularity formed in the external surface of material tubing at metal mold inner circumference as drawing 1 explained.

[0036] After press fit by two or more rodding 20A held at one rodding holder 38 A-a finishes Rodding holder 38 A-a retreats leftward to the part of stacker frame 40A. One case shift of rodding holders in stacker frame 40A is carried out in the vertical direction (for example, above) by elevator style 42A. Rodding holder 38 A-c of the following order of processing is extruded rightward [of drawing 9] by piston 44A-1, rodding 20A' held at rodding holder 38 A-c is pressed fit in the interior cavity of shaft orientations of the material tubing 18, and rolling actuation of the next phase is carried out.

[0037] Rodding holder 38 B-a which that of the structure of stacker 36B arranged on the right-hand side of the metal mold bed 30 in drawing 9 is the same as that of left-hand side it, and has been arranged in the vertical direction multistage, 38 B-b, and 38 B-c, Rodding holder 38 B-a, 38 B-b, and 38 B-c It consists of elevator style 42B to which rise and fall of rodding holder 38 B-a within stacker frame 40B held free [vertical sliding] and stacker frame 40B, 38 B-b, and 38 B-c are made to perform. Moreover, oil hydraulic cylinder 44B for press fit control is prepared in the outside of right-hand side rodding holder stacker 36B. Sequential engagement of piston 44B-1 of press fit control oil hydraulic cylinder 44B is carried out at rodding holder 38 B-a held at stacker 36B, 38 B-b, and 38 B-c. The selected rodding holder is moved to the left from the right of drawing, rodding held at the rodding holder is pressed fit towards the internal cavity of the material tubing 18 clamped by metal mold 110, and the irregularity of a ****** configuration is given to the irregularity formed in the external surface of material tubing at metal mold inner circumference as drawing 1 explained. Moreover, one step of rodding holder in stacker frame 40B is shifted at a time in the vertical direction by elevator style 42B.

[0038] Although the shift of a rodding holder on either side is performed in linkage according to advance of a press fit phase, in each phase, rodding on either side is pressed fit in the material tubing 18 by turns, as explained in relation to drawing 1 . Namely, the 2nd-step rolling actuation is carried out in drawing 9 . Rodding 20A to which rodding 20A held at left-hand side rodding holder 38 A-b was moved rightward by piston 44A-1 of a press fit cylinder is pressed fit in each material tubing 18 clamped by each metal mold 110 of a horizontal pile all at once. Rodding 20A held at rodding holder 38 A-b after the press fit finished is pulled back by left-hand side. Rodding 20B which was made to carry out a lap to the pull back, and was held at right-hand side rodding holder 38 B-b of the 2nd step is moved leftward [of drawing 9] by piston 44B-1 of press fit cylinder 44B, and rodding 20B is pressed fit in each material tubing 18 clamped by the metal mold 110 of a horizontal pile all at once. And press fit of right and left of such rodding

holder 38 A-b and 38 B-b is similarly carried out repeatedly two or more times with having explained in relation to drawing 1 . this -- a stage -- rolling -- actuation -- completing -- if -- left-hand side -- a stacker -- and -- right-hand side -- a stacker -- a shift -- predetermined -- a direction -- for example, -- above -- carrying out -- having -- a degree -- a stage -- a sake -- rodding -- a holder -- 38 -- A-c -- 38 -- B-c -- holding -- having had -- rodding -- 20 -- A -- ' -- 20 -- B -- ' -- two or more -- a ** -- coincidence -- right and left -- alternation -- a material -- tubing -- pressing fit -- having -- this -- a phase -- rolling -- actuation -- carrying out -- having .

[0039] It sets to drawing 8 and the rolling method of 10, and each is made to carry out coalesce maintenance of the split mold 112 which constitutes each metal mold, and 114, when the horizontal pile of two or more horizontally divided metal mold 110 is carried out and it pressurizes from both sides. When rodding is pressed fit to material tubing held at metal mold, with rodding insertion pressure, overturning moment M received on a bed 30 puts welding pressure P on the distance L from a bed to the core of metal mold, metal mold serves as M=LxP, but since two or more metal mold is made into the horizontal pile, the value of an overturning moment has the advantage which becomes completely the same as that of the case where the number of metal mold is one.

[0040] Moreover, by the denial of the reaction force between contiguity metal mold, the holding power at the time of piling up two or more metal mold in the pressurization direction (longitudinal direction) about the welding pressure by the oil hydraulic cylinder 32 which holds the metal mold 110 at the time of rodding press fit in the closing condition is the same as that of the welding pressure holding the metal mold of a piece, and does not need to adopt a thing large-sized as an oil hydraulic cylinder 32 for two or morecarat mold.

[0041] In the operation gestalt of this invention, although the migration direction of core bar 20A and 20B and the migration direction of metal mold 110 are in a horizontal plane, as shown in drawing 8 , tolerance is mutually carried out to the shape of a cross joint. Therefore, as shown in drawing 9 , the upper part of metal mold 110 forms the space opened wide altogether substantially. Therefore, a loader 111 can perform loading to the metal mold 110 of new material tubing 18' which is a work piece, and drawing of a product in the vertical direction like an arrow head b1 and b2. Moreover, since the upper space of metal mold has opened wide completely, it is effective in the maintenance becoming easy. Moreover, since it has the structure where stacker frame 40A for core bar holder 38 A-a, 38 A-b, 38 A-c, 38 B-a, 38 B-b, and 38 B-c and 40B can also be opened wide up, the maintenance can also be easy-ized.

[0042] the split mold 112 with which drawing 10 and drawing 11 constitute each metal mold 110, and the cleaning liquid injection nozzle in 114 -- it bites and the work-piece kick out is shown. That is, the shower ring of a lot of coolant is needed for superfluous are recording of generation of heat of plastic working by continuous molding. Moreover, it is necessary to inject a penetrant remover powerfully at coincidence to a concavo-convex rolling metal mold side and the clamp side of the opposite side at the time of metal mold opening of the work-piece ejection working-level month at the time of the continuous-molding termination after one clamp, to exclude the dust of the dregs and others for phosphate coating processing each time, and to maintain the purity of metal mold, and it necessary to prevent generating of a blemish. For that purpose, it is desirable to plan so that fall distance of a penetrant remover and a bed side may be shortened and

quick washout may be performed. That is, an injection nozzle 112-1 and 114-1 are carrying out opening to the split mold 112 and the shaping side of 114, when a split mold can open after rolling, cleaning liquid is injected towards the other party's split mold from an injection nozzle 112-1 and 114-1, and cleaning and cooling can be performed. Moreover, it bites, and a work-piece kick out can be constituted by a pin 112-2 and 114-2, and can project now a pin 112-2 and the work piece bit to the inside of a mold by ejection actuation of 114-2. Blemish generating prevention of one clamp can be brought about by this structure adoption.

[0043] Drawing 12 and drawing 13 show an example of the concrete supporting structure of the cylinder for rodding press fit. Since drawing 12 and drawing 13 are brief, although only the oil hydraulic cylinder 44 for the rodding press fit on the right-hand side of metal mold 110 is shown, the oil hydraulic cylinder same also on the left-hand side of the ****** metal mold 11 as drawing 9 is prepared. 130 is oil hydraulic cylinder susceptor and the cross-section horseshoe-shaped housing 132 is attached on the oil hydraulic cylinder susceptor 130. From the inside of the surface of a housing 132, suspension formation of the reverse bending rib 134 which set spacing of a pair is carried out at the shape of a cantilever. The body of an oil hydraulic cylinder 44 is fixed to the reverse bending rib 134. From an oil hydraulic cylinder 44, a piston rod 44-1 is prolonged, the rodding holder 38 attaches at the tip of a piston rod 44-1, and rodding 20 is held at an eclipse and the rodding holder 38. If a piston rod 44-1 develops, the rodding 20 held at the rodding holder 38 and the rodding holder 38 at a tip of a piston rod 44-1 will develop, it will be pressed fit in the material tubing 18 held at the metal mold 110 on a mold 110, and encaustic attachment will be performed on the front face on which flattening of the material tubing 18 was carried out.

[0044] If an operation of drawing 12 and the reverse bending rib 134 of drawing 13 is explained, an oil hydraulic cylinder 44 will be cantilever installation, and a housing 132 will bend upward with the stress at the time of press fit of the rodding 20 to the material tubing 18. Supposing it remains this bending of a housing 132 as it is, namely, has formed the direct oil hydraulic cylinder 44 in the housing 132, the pressurization axial center of rodding 20 can be shifted upward, and it will become the cause of the life-shortening of rodding 20. On the other hand, with drawing 12 and the operation gestalt of drawing 13 , the oil hydraulic cylinder 44 is installed in the reverse bending rib 134 by which cantilever installation is carried out from the upper part plate of a housing 132. The bending direction of the reverse bending rib by the stress at the time of press fit of the rodding 20 to the material tubing 18 is downward [opposite to the bending direction of a housing 132]. Therefore, since it becomes small or it can offset upward bending of a housing 132 by downward bending of the reverse bending rib 134 and a gap of the pressurization axial center of rodding 20 does not arise by designing the reverse bending rib 134 appropriately, it is effective in the life of rodding 20 being extensible.

[0045] the case where a thing high as process tolerance is not needed if the split mold 112 which constitutes the metal mold 110 used for the equipment of drawing 8 and drawing 9 , and the configuration of 114 are explained, and a configuration -- processing -- an easy thing can constitute the concavo-convex die itself as a clamp mold, as already explained in relation to drawing 2 . However, it is necessary to require precision, to carry out independent processing of the concavo-convex shaping section itself about what has the high difficulty of configuration processing, and to consider as the configuration which

laid the mold under the clamp split mold. In this case, let a clamp split mold be a split mold holder. In this case, the powerful mold injection nozzle of the penetrant remover for blemish generating prevention is embedded from a viewpoint of installation by the minimum distance at this split mold clamp. Moreover, if a work piece should bite, there is a possibility of causing breakage of work-piece ejection equipment. Therefore, it is desirable to build the compulsive ejection equipment of a work piece into a clamp mold. Moreover, if dispersion is in opening of a work piece, since the gas supply pressure failure of a work piece will be invited and it will become the factor of productivity inhibition, it is desirable to incorporate equipments, such as injection nozzle work-piece knockout-die opening dimension regulation for eliminating this.

[0046] Next, the case where do not stage-picking-change the product of two or more forms, and it is processed with the equipment of the multistage shift expression of a rodding holder is explained. First, if the number of rodding held at a rodding holder is explained, odd number is desirable, the number of rodding is 3 in drawing 8 , and you may make it hold five rodding to rodding holder 38A and 38B like drawing 14 , respectively. If in charge of coincidence shaping of a different form, even if it is the case where various kinds of formation insertion pressure differs, it is necessary to make it the eccentric load to a rodding press fit cylinder not occur. In drawing 14 , coincidence processing of three forms of A, B, and C is performed, the case where the volume is A<B<C is assumed, and if B is processed on the both sides and C is processed for A with few production numbers at the core in the outermost part, balance can be maintained. Moreover, naturally shaping by one rodding shall be of use for the form with few volumes. moreover -- the case where full equipment of the five rodding A, B, and C is carried out at a rodding holder -- A sorts -- production -- if the material tubing 18 for A sorts is not supplied to metal mold 110 as shown in drawing 14 when it becomes unnecessary, it can come out as it is, without carrying out desorption of the rodding in the rodding clamp mold for A sorts, and processing can be continued.

[0047] Next, the case where do not stage-picking-change the product of two or more forms, and it is processed with the equipment of the multistage shift expression of the rodding holder shown in drawing 8 and drawing 9 is explained. If the case where the product of A sequence manufactured at six processes and the product of B sequence manufactured at ten processes are manufactured with the machine which equipped right and left with eight steps of stackers is mentioned as an example, in A sequence, three steps of stacker tops on either side and B sequence will use five steps of stacker bottoms on either side. The product of A sequence can be manufactured because start from an upper case and 6 ** perform drawing of rodding from a stacker, press fit of rodding, and pull back more nearly alternately with right and left. Moreover, total 10 process is carried out by carrying out alternately with right and left about the stacker of five steps of bottoms, and B sequence can be acquired for a product. Moreover, by using it four steps of upper and lower sides at a time on either side about Sequences C and D, it stage-picking-changes, and in the case of the sequences C and D which can be manufactured at eight processes, respectively, it is nothing, and it can be cleared up.

[0048] drawing 15 shows various kinds of example a-r of combination which stepless-picking-changes, comes out and performs coincidence processing of varieties. O**** shows the gestalt of processed material tubing symbolically. (b) of drawing 15 shows the combination at the time of coincidence processing by one rodding holder 38A and 38B,

and as explained in drawing 14 in this case, symmetry arrangement of the odd core bar is carried out so that an eccentric load may not arise. (**) of drawing 15 shows the combination in the shift direction (the vertical direction) in stacker 36A on either side and 36B, and adopts a suitable combination according to the combination of the form to produce. That is, a, g, and m are the cases where there is only an order of only the item of O, **, and **. What is necessary is just to lessen metal mold which sets material tubing, if there are few orders. O And if there may be an order of **, it will become the combination of Examples b and h and the number of sets of material tubing will be adjusted according to the number of orders of O and **. therefore, arrangement of rodding and metal mold is left as it is, and required in a required form, if it changes stage picking and puts in another way nothing -- number production can be carried out. O When three forms of ** and ** need to be produced, according to the ratio of that burst size, Examples c, d, e, f, i, j, k, l, and n, **, p, q, r, etc. are chosen, and also in this case, coincidence processing of three forms can be changed stage picking, and can be performed nothing.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing 1 is drawing explaining the principle of the shaping rolling in this invention.
[Drawing 2] Drawing 2 is the sectional view of metal mold, and, as for open condition (b), (b) shows a closing condition.
[Drawing 3] Drawing 3 is drawing showing typically the flow condition of the material to the crevice of metal mold, (b) shows this invention and (b) shows the conventional technique.
[Drawing 4] Drawing 4 is drawing showing various kinds of cross-section configurations of metal mold.
[Drawing 5] Drawing 5 is drawing showing an example of the shape of toothing which can be formed by this invention.
[Drawing 6] Drawing 6 is the side elevation of rodding.
[Drawing 7] Drawing 7 is the front view of rodding.
[Drawing 8] Drawing 8 is the rough top view of the equipment of the rodding multistage shift mold coincidence a large number processing type which is implementation of this

invention.
[Drawing 9] Drawing 9 is the side elevation of the equipment of drawing 8 .
[Drawing 10] Drawing 10 is the longitudinal direction sectional view of the metal mold shown where a split mold is separated.
[Drawing 11] Drawing 11 is the cross-sectional view of the metal mold of drawing 10 , and is expressed along with the XI-XI line of drawing 10 .
[Drawing 12] Drawing 12 is the side elevation showing the distorted orthodontic appliance of the pressurization axial center of the oil hydraulic cylinder for rodding pressurization.
[Drawing 13] Drawing 13 is a view sectional view expressed along with the XIII-XIII line of drawing 12 . Right ** 1 is the cross-sectional view of the metal mold of drawing 10 .
[Drawing 14] Drawing 14 is drawing showing the rodding arrangement in the rodding holder in the case of performing variety coincidence processing.
[Drawing 15] Drawing 15 is drawing [in / by this invention / multistage shift coincidence variety processing] which changes stepless picking and explains a processing method.
[Description of Notations]
10 -- Metal mold
12 -- Punch
14 -- Female mold
18 -- Tube
20A, 20B -- Rodding
20A', 20B' -- Rodding
20A", 20B" -- Rodding
20-1 -- The interior of a proposal of rodding
20-2, 20-4 -- The taper section of rodding
20-3, 20-5 -- The diameter expansion section of rodding
32 -- Pressurization cylinder
34 -- Pressure receiving frame
36A, 36B -- Stacker
38 A-a, 38 A-b, 38 A-c -- Rodding holder
38 B-a, 38 B-b, 38 B-c -- Rodding holder
40A, 40B -- Stacker frame
42A, 42B -- Elevator style
44A, 44B -- Press fit control oil hydraulic cylinder
44A-1, 44B-1 -- Piston of a press fit control oil hydraulic cylinder
110 -- Metal mold
112 114 -- Split mold
120 -- Rodding
120-1 -- The interior of a proposal
120-2, 120-4, 120-6 -- Taper section
120-3, 120-5, 120-7 -- Diameter expansion section

[Translation done.]

* NOTICES *

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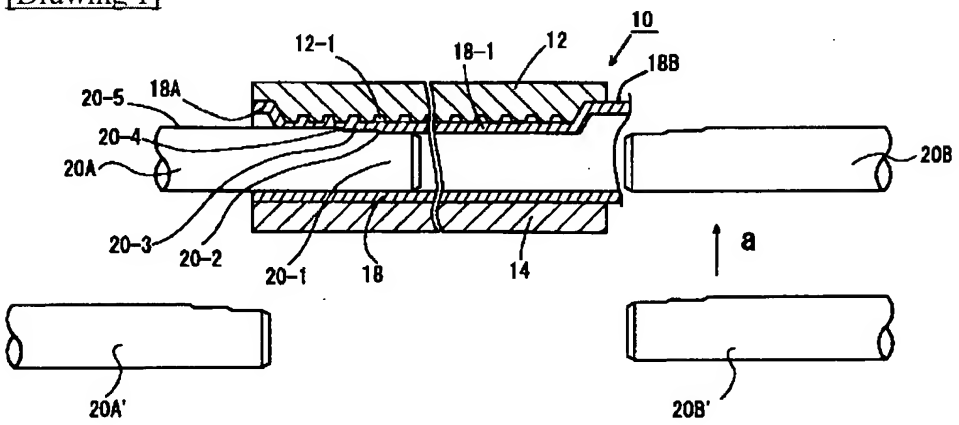
1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

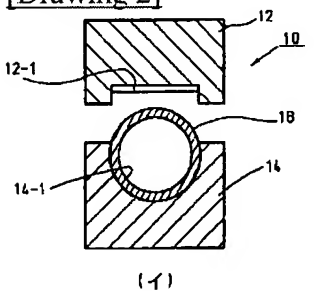
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



[Drawing 2]



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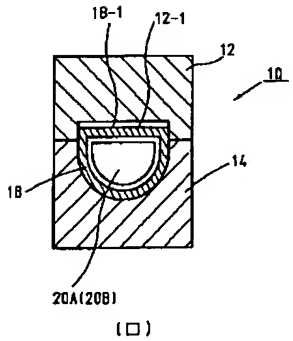

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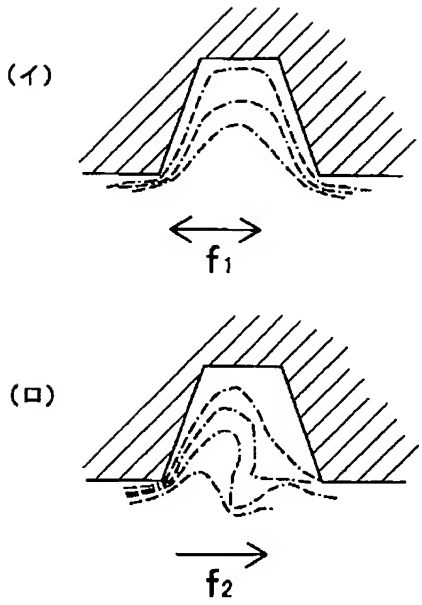
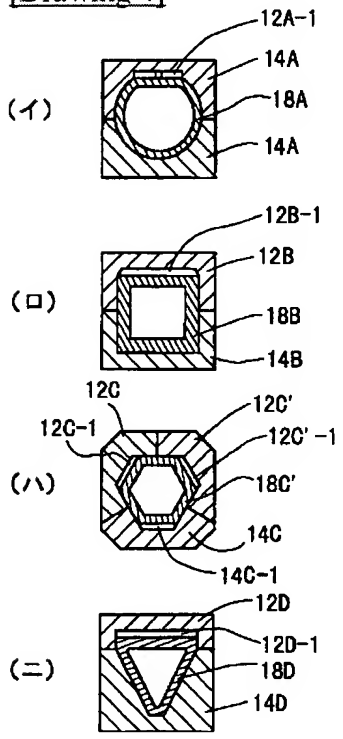
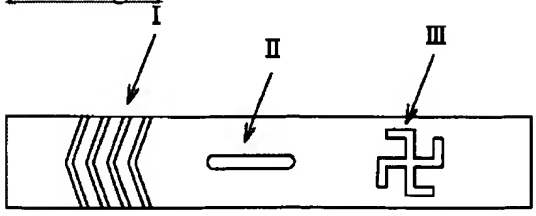
[Drawing 3]



[Drawing 4]

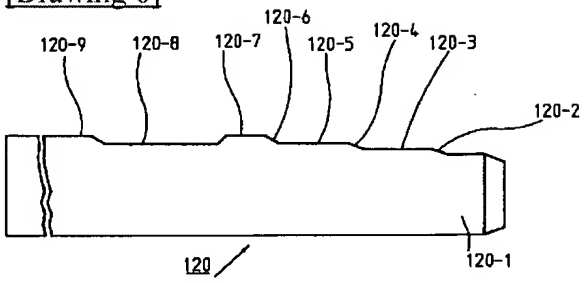


[Drawing 5]

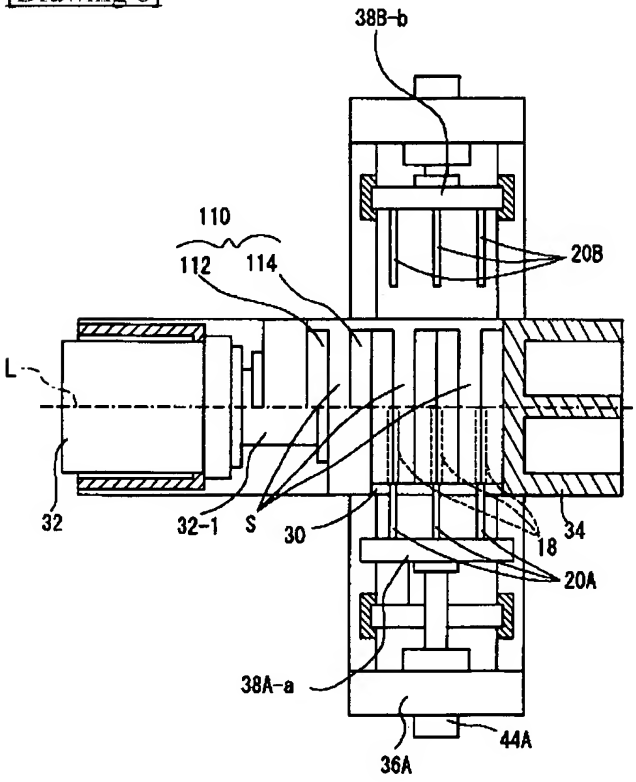


[Drawing 7]

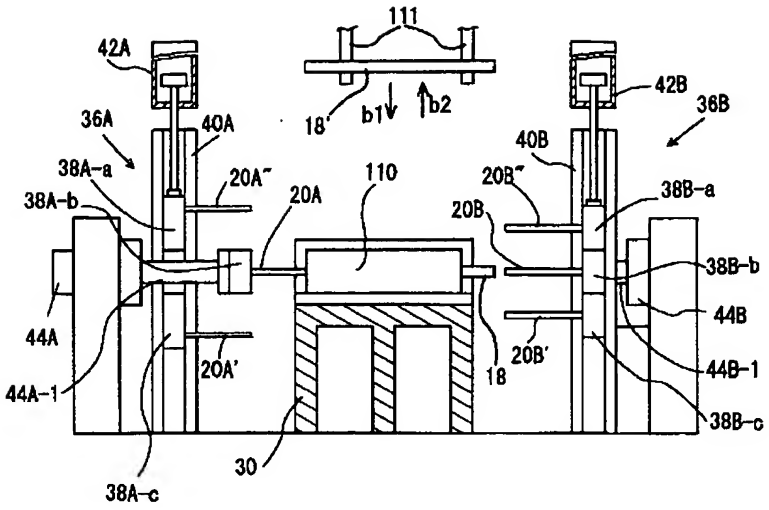
[Drawing 6]



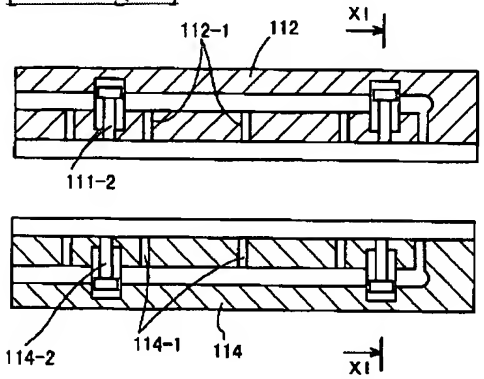
[Drawing 8]



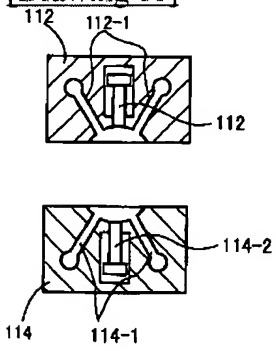
[Drawing 9]



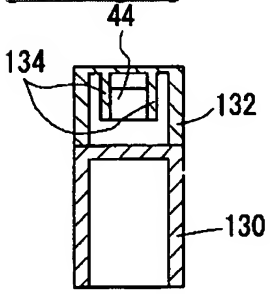
[Drawing 10]



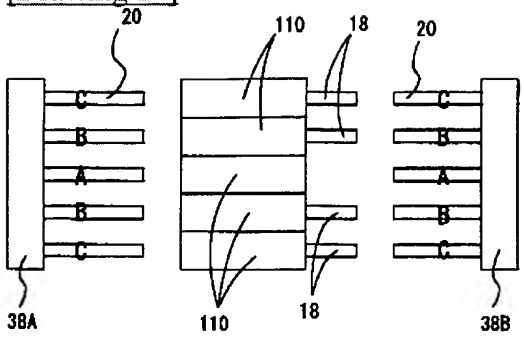
[Drawing 11]



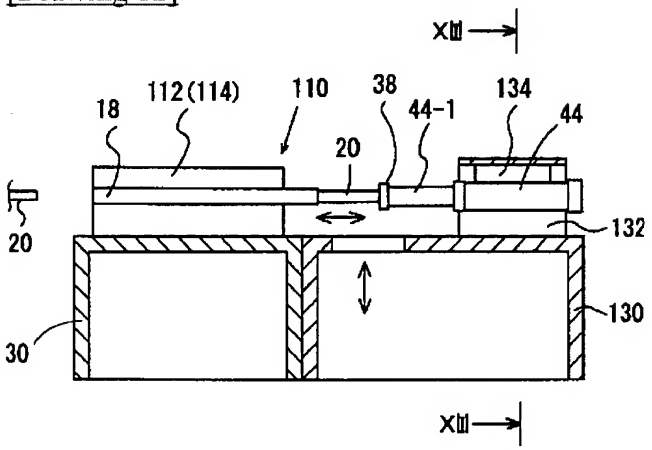
[Drawing 13]



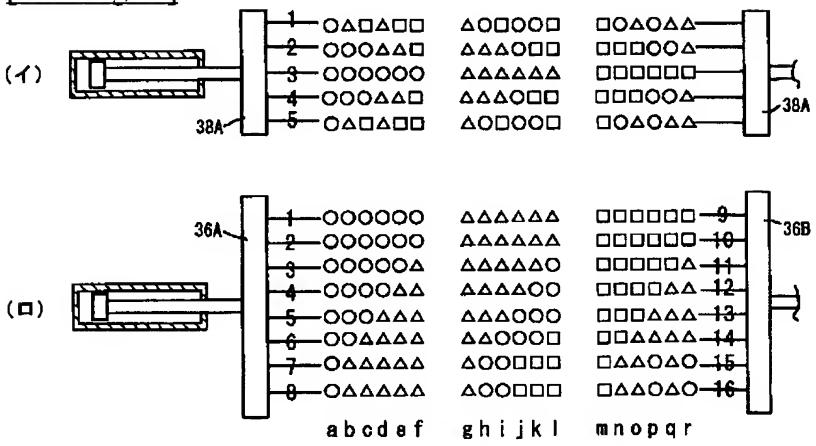
[Drawing 14]



[Drawing 12]



[Drawing 15]



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5/06			5/06	Ｚ
5/12			5/12	Ｚ
13/02			13/02	Ｃ
Ｂ２１Ｋ　27/00		Ｂ２１Ｋ	27/00	Ｚ

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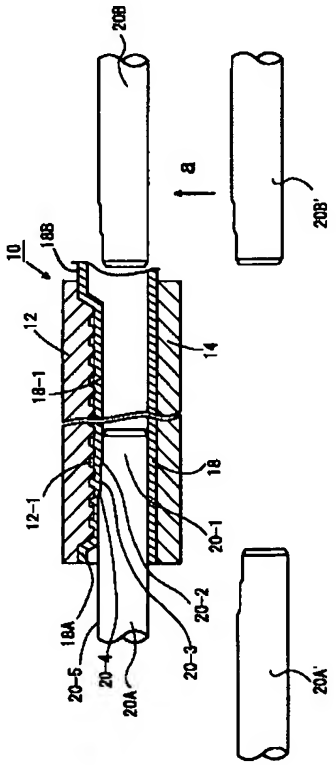
(54)【発明の名称】　直線駆動式成形転造装置

(57)【要約】
【解決課題】この発明は直線駆動式成形転造方法及び装置に関し、彫り込みの深い任意の形態の凹凸加工を高い精度でかつ効率良く形成する事を目的とする。
【解決手段】　内面に凹凸12-1を有した上型１２と下型１４との間に異形断面の素型材１８を保持しつつ、芯金20A，20Bを前記素型材の軸方向の空洞に圧入し、芯金のテーパ部20-2，20-4及びこれに継続する拡径部20-3，20-5により素材の肉を上型１２の凹凸12-1に向けて金属流動させることにより張り出させ、素型材１８の外周に上型内周の凹凸12-1に順じた形状を付与する。素型材１８はその両端間で貫通する空洞を有しており、素材１８の一端からの芯金20Aの圧入と素材の他端からの芯金20Bの圧入とは左右から交互に行われる。



【特許請求の範囲】

【請求項１】　横方向に重ねて配置される横割の複数の割型と、割型を載置するためのベッドと、横方向に重ねて配置される割型に対しその両側から挟むように加圧することにより複数の直線状の異形断面の素型材をそれぞれの割型に加圧保持せしめる加圧手段と、複数の芯金を横方向に平行に離間して保持する芯金ホルダと、芯金ホルダにより保持された複数の芯金を各割型に保持されたそれぞれの素型材の軸方向の空洞に向けて一斉に圧入するための芯金圧入手段とを備え、素型材への芯金の圧入による素型材の外周への金型内周の凹凸に準じた形状の形成が複数の素型材について一挙に行われることを特徴とする直線駆動式成形転造装置。

【請求項２】　横並びで配置された複数の割型と、各割型を型合わせ方向に加圧することにより直線状の異形断面の素型材をそれぞれ保持せしめる加圧手段と、平行に離間した複数の芯金ホルダを複数工程順に従って積み重ね状に保持するためのスタッカと、スタッカに積み重ね状に保持された芯金ホルダのうちの任意の一つのホルダをスタッカから取り出すとともに使用済みのホルダを芯金ホルダに返却する手段と、その一つの芯金ホルダにより保持され芯金を対応の割型に保持された素型材の軸方向の空洞に向けて一斉に圧入しかつ引き戻すための芯金圧入・引戻手段とを備え、スタッカに積み重ねられた複数の芯金ホルダより一づつ芯金ホルダを工程順に従ってスタッカから取り出し、各素型材への芯金の圧入が異なった芯金により多段階に行われることを特徴とする直線駆動式成形転造装置。

【請求項３】　請求項１若しくは２に記載の発明において、金型の上方に外部に開放した空間が形成され、該空間に金型への素材の装入及び製品の搬出のためのローダーが設置されることを特徴とする直線駆動式成形転造装置。

【請求項４】　請求項１若しくは２に記載の発明において、スタッカは割型の両側に設置され、スタッカに積み重ねられた複数の芯金ホルダより一つづつ芯金ホルダを工程順に従って両側のスタッカより交互に取り出し、各素型材への芯金の圧入が異なった芯金により多段階に行われることを特徴とする直線駆動式成形転造装置。

【請求項５】　請求項４に記載の発明において、一方の側のスタッカからの芯金ホルダにおける芯金のための往復駆動機構と反対側のスタッカからの芯金ホルダにおける芯金の往復駆動機構とは独立のタイミングにて駆動されることを特徴とする直線駆動式成形転造装置。

【請求項６】　割型と、割型を型合わせ方向に加圧することにより直線状の異形断面の素型材を保持せしめる加圧手段と、芯金を割型に保持された素型材の軸方向の空洞に向けて圧入しかつ引き戻すための油圧シリンダ手段とを備え、該油圧シリンダ手段は撓み角度相殺用の逆撓みリブに取り付けられることを特徴とする直線駆動式成形転造装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は軸方向の空洞を有した三角、四角、多角、異形、円形などの各種の断面形状の素型材の一部もしくは全体の表面に彫り込みの深い任意の形態の凹凸加工を高い精度でかつ効率良く形成する直線駆動式成形装置に関するものであり、一例を挙げると、自動車のステアリング部品であるラックバーの製造に応用することができるが、この発明はラックバーの製造に限らず各種の機械機能部品や装飾部品に所望の表面凹凸形状ないしは模様を付すのに応用することができるものである。

【０００２】

【従来の技術】自動車のステアリング部品であるラックバーを中空素型材から転造により成形する技術は原理的には公知である。即ち、ラックバーの転造成形においては、まず、加熱によって軟化された中空素型材を型によって保持しつつプレスをかけることにより中空棒のラック形成面の平坦化が行われる。次に、内周に直線方向の歯列を有した成形型を中空棒の前記平坦部に当てつつ外側より中空棒の空洞に芯金が圧入される。芯金はテーパ状の作用部を有しており、テーパ部が平坦部に内周側において係合することにより平坦部の肉は成形型に向けて塑性変形的に流動することにより張り出され、平坦部に成形型の歯列に順じた形状の直線方向の歯列が付与される。心金の一回の圧入のみでは所期の精度の製品は得られないため、作用径が順次変化した心金をタレット型に配置し、心金の作用径を順次変更しながら加工を行うことが提案されている。

【０００３】

【発明が解決しようとする課題】タレット型のものでは一つの割型毎に作用径の変化するタレットが必要であり、一回の圧入操作によって得られる製品は一個のみであり、生産効率としては極度に悪化してしまい、鍛造によるラックバー製造のメリットは殆ど生かせないためタレット型のものはこれまで実用には殆ど供されていなかった。この発明はこの問題点に鑑みてなされたものであり、タレット型の欠点を解消し、複数の心金の一斉圧入を可能とすることにより複数製品の同時製造を実現するとともに精度的にも切削品と遜色がなく、しかもコスト的にも安価に押えうるようにすることを目的とする。

【０００４】請求項１に記載の発明によれば、横方向に重ねて配置される横割の複数の割型と、割型を載置するためのベッドと、横方向に重ねて配置される割型に対しその両側から挟むように加圧することにより複数の直線状の異形断面の素型材をそれぞれの割型に加圧保持せしめる加圧手段と、複数の芯金を横方向に平行に離間して保持する芯金ホルダと、芯金ホルダにより保持された複数の芯金を各割型に保持されたそれぞれの素型材の軸方

向の空洞に向けて一斉に圧入するための芯金圧入手段とを備え、素型材への芯金の圧入による素型材の外周への金型内周の凹凸に準じた形状の形成が複数の素型材について一挙に行われることを特徴とする直線駆動式成形転造装置が提供される。

【０００５】請求項１の発明の作用・効果を説明すると、横方向分割の割型は複数が横重ねに配置され、そして横重ねの割型に両側から加圧手段による加圧力が加えれ、そして、各素型材をそれぞれの割型によりクランプした状態でホルダにより保持された複数の芯金が夫々の素型材の空洞への一斉に圧入され、各素型材の転造が同時に行われる。このとき、芯金圧入によって割型よりベッドに加わる転倒モーメントは割型が一つの場合と同様となる。割型を縦割りとしこれを横並びとして上下に一斉にクランプしようとする場合、クランプ力が巨大となるし、個々の割型を別個にクランプ使用とすると割型のセット数に一致した加圧手段が必要となるが、この発明では横割の割型を横重ねにして横方向の両側からクランプすることで、クランプ力を少しも増大させることなく加圧手段を一個で済ませることができ、コスト的に極めて有利な効果を得ることができる。

【０００６】請求項２に記載の発明によれば、横並びで配置された複数の割型と、各割型を型合わせ方向に加圧することにより直線状の異形断面の素型材をそれぞれ保持せしめる加圧手段と、平行に離間した複数の芯金ホルダを複数工程順に従って積み重ね状に保持するためのスタッカと、スタッカに積み重ね状に保持された芯金ホルダのうちの任意の一つのホルダをスタッカから取り出すとともに使用済みのホルダを芯金ホルダに返却する手段と、その一つの芯金ホルダにより保持され芯金を対応の割型に保持された素型材の軸方向の空洞に向けて一斉に圧入しかつ引き戻すための芯金圧入・引戻手段とを備え、スタッカに積み重ねられた複数の芯金ホルダより一づつ芯金ホルダを工程順に従ってスタッカから取り出し、各素型材への芯金の圧入が異なった芯金により多段階に行われることを特徴とする直線駆動式成形転造装置が提供される。

【０００７】請求項２の発明の作用・効果を説明すると、芯金ホルダにはその加工段の芯金が数本まとめてなるべくはワンタッチで着脱自在に保持され、各加工段の芯金ホルダは加工順序に従ってスタッカに積み重ね状にセットされる。スタッカより加工順序に準じて芯金ホルダが取り出され、芯金ホルダに保持された芯金は横並びの割型にクランプされた対応の素型材に一斉に圧入され、圧入工程の終了後に芯金は引き抜かれ、数回の圧入・引き戻しの繰り返し後に、芯金は芯金ホルダともどもスタッカに再収納され、スタッカのシフトなどの操作により次の加工順の芯金を保持した芯金ホルダがスタッカより取り出され、以下同様に芯金の圧入ー引引き戻しスタッカへの収納ー次の段階の芯金ホルダの取り出しが繰り返される。この構成により多段階的な転造操作を極めて効率的に実施できる効果がある。

【０００８】請求項３に記載の発明によれば、請求項１若しくは２に記載の発明において、金型の上方に外部に開放した空間が形成され、該空間に金型への素材の装入及び製品の搬出のためのローダーが設置されることを特徴とする直線駆動式成形転造装置が提供される。

【０００９】請求項３の発明の作用・効果を説明すると、ローダーにより開放した金型の上方から素材の装入、製品の搬出ができるため、空間の有効活用が実現され、装置全体をコンパクトにできる。

【００１０】請求項４に記載の発明によれば、請求項３に記載の発明において、スタッカは割型の両側に設置され、スタッカに積み重ねられた複数の芯金ホルダより一つづつ芯金ホルダを工程順に従って両側のスタッカより交互に取り出し、各素型材への芯金の圧入が異なった芯金により多段階に行われることを特徴とする直線駆動式成形転造装置が提供される。

【００１１】請求項４の発明の作用・効果を説明すると、左右のスタッカから芯金ホルダを工程順に従って順次取り出し、取り出された芯金ホルダの芯金を左右交互に圧入しているため、薄肉管表面への深い凹凸模様の転造を精度高く実施することができる効果がある。

【００１２】請求項５の発明によれば、請求項４に記載の発明において、一方の側のスタッカからの芯金ホルダにおける芯金のための往復駆動機構と反対側のスタッカからの芯金ホルダにおける芯金の往復駆動機構とは独立のタイミングにて駆動されることを特徴とする直線駆動式成形転造装置が提供される。

【００１３】請求項５の発明の作用・効果を説明すると、左右独立の駆動タイミングの選定は多品種少量生産システムに対する適合性を高め、一台の機械により異なった製品を段取り変えなしに又は最小の段落変えで生産することを実現できる。

【００１４】請求項６に記載の発明によれば、割型と、割型を型合わせ方向に加圧することにより直線状の異形断面の素型材を保持せしめる加圧手段と、芯金を割型に保持された素型材の軸方向の空洞に向けて圧入しかつ引き戻すための油圧シリンダ手段とを備え、該油圧シリンダ手段は撓み角度相殺用の逆撓みリブに取り付けられることを特徴とする直線駆動式成形転造装置が提供される。

【００１５】請求項６の発明の作用・効果を説明すると、この発明の実施において、割型のクランプ方向と芯金の圧入方向がX，Yの十字状に直交する配置となり易い。この十字配置の場合X軸の加圧手段もY軸の加圧手段も中間に支柱を設けることが作業性の維持のため困難であり、片持ち支持となる。この場合構造的に応力歪による突出顎部の開口が発生し、加圧軸心にずれが生じ易い。このずれは芯金の寿命を短くするおそれがある。こ

れに対し第７の発明においては、加圧装置の顎部に直接シリンダを設けず、撓み角度相殺用の逆撓みリブを追加しこれにシリンダを設けることにより、顎部とリブとの間に相互に反対方向の歪が生じ、歪を打ち消しまたは小さくすることができ、軸心のずれを防止又は最小とすることができる。

【００１６】

【発明の実施の形態】図１及び図２はこの発明の一実施形態としての金属円管からの車両のステアリング部品である中空ラックの転造形成を概略的に示すものである。割型としての金型１０は上型１２と下型１４とから構成され、図２と金型１０の断面を（イ）において開放状態、（ロ）において閉鎖状態にて示す。上型１２は下型１４に面したその内周面における長さ方向凹部にラック歯状の歯部12-1を有しており、一方、下型１４は上型１２に面した上面に断面半円弧状の長さ方向溝14-1を形成している。図２の（イ）では下型１４の断面半円弧状長さ方向溝14-1に円管１８がすでに載置された状態を示している。

【００１７】図２の（イ）の状態から上型１２と下型１４とを相互に向き合う方向に移動させることにより図２の（ロ）のように金型１０を閉鎖すると、円管１８は上型１２に面する上半分18-1が平坦に潰され、ラック歯の成形転造を受けるべき異形の素型材となる。図１は図２の（ロ）に示す閉鎖状態における金型１０の長さ方向断面図を示す。金型１０は円形断面の素材管１８の約１／２以下の長さしかない。そして、円管１８の一端は金型１０と面壱であるが、反対端は１／２の長さ以上突出している。しかしながら、下型１４に面した上型１２の下面に形成される歯部12-1は金型１０の端面から幾分手前に留まっており、従って、金型１０の閉鎖状態において素材管１８の左端１８Ａ及び右端１８Ｂは平坦に圧潰されておらず、換言すれば素材管１８の両端18A，18Bは円形断面のままに留まっている。

【００１８】図１及び図２に説明したこの発明の実施形態では素材管１８のラック形成面である上面の平坦化＝異形素型材の形成をラック転造形成用金型１０の閉鎖即ち上型１２と下型１４との合体によって行っている。即ち、上型１２のラック状歯部12-1は金型閉鎖時は下型１４の底面からの距離が素材管１８の外径の半分強のところに来るため素材管１８は上型１２のラック状歯部12-1によって図２の（ロ）に示すように平坦に潰されるのである。そのため、金型１０は型開きすることなくそのまま連続して次の工程に順次移行することができる。これにより、工程をラップ化できると共に、クランプ動作を最初の１回のみにすることができるためクランプによる傷の発生の機会をなくすることができる利点がある。また、転造用の型を異形化のために使用していることから異形化の精度は異形化専用の本来の型を使用した場合と比較して低下があるが、要求精度がよほど高くない限りは実際上の問題はないことがわかった。平坦化のため専用の型により円管の上面を潰し、その後型開きし、転造用の金型にクランプするような通常の工程をとることももとより可能である。

【００１９】図１において、割型12，14間に保持された断面平坦化後の素材管１８は芯金の圧入・引き戻しによるこの発明の転造工程を受ける。以下、これについて説明すると、芯金20A，20Bは金型１０にクランプされることにより上面が平坦化されたた素材管１８の両側に軸方向に対向して配置される。芯金20A，20Bはその断面形状は図２の（ロ）に示すように断面平坦化された素材管１８の部分の断面形状に順じた断面形状を有している。図１に示すように芯金20A，20Bの先端は案内部20-1をなしており、断面平坦化された素材管１８の部分への導入のガイドとなる。案内部20-1の背後にはテーパ部20-2を経由して拡径部20-3が継続し、芯金20A，20Bの圧入時にテーパ部20-2は素材管１８の平坦部18-1に係合することにより素材管の肉を内から外に金型のラック歯状部12-1の凹凸に向けて金属流動させ、素材管の平坦部18-1にその凹凸形状に相補的なラック状歯部が賦型される。図１では芯金20A，20Bは第１の拡径部20-3に後続してテーパ部20-4を介して第２の拡径部20-5が続いており、一本の芯金による順次の多段階の金属流動が得られるようになっている。

【００２０】図１においては第１の工程として左側の芯金２０Ａが平坦化されたばかりの素材管１８に圧入された最初の状態を示している。左側の芯金２０Ａの圧入は素材管の平坦部18-1の右端に最後の拡径部20-5が到達するまで行われ、その後芯金２０Ａは素材管１８から完全に抜去される至るまで左側に向けて移動される。

【００２１】左側の芯金２０Ａの抜去と適切なラッピングのタイミング差をもって右側の芯金２０Ｂは図１の左側への移動を開始し、右側の芯金２０Ｂが素材管１８の内部空洞に導入されるに至り、その拡径部により左側の芯金２０Ａについて説明したものと同様な金属流動の過程が惹起される。

【００２２】右側芯金２０Ａの圧入ー抜去及びこれに継続する左側芯金２０Ｂの圧入ー抜去は数回繰り返される。即ち、素材管１８に対する左右の芯金20A，20Bの圧入が交互に複数回繰り返される。素材管１８の内部空洞に対する各芯金20A，20Bの繰り返し的な圧入は金型の凹部に対する肉の確実な流動を促すことができる。即ち、芯金の一回の圧入のみでは肉の流れが不充分であり、精度の高い転造が行いえない恐れがあるが、繰り返し的な圧入によりこのようなおそれを回避することができる。また、左右の芯金20A，20Bの複数回の交互圧入により金型の凹部に対する均等な金属流動を得ることができ、精度の高い転造を実現できる効果がある。即ち、図３は転造により得られた実際のラックの歯部の断面顕微鏡写真における歯部の層形成状態から把握された肉の流動状態

を模式的に表したものである。矢印f_1に示すような交互圧入を行うこの発明の肉の流動状態は（イ）にて表され対称的な流動状態が得られていることが分かる。一方、（ロ）は芯金の圧入方向が矢印f_2のような一方のみである場合の流動状態を示しており、この場合は肉の流動に片寄りがあり、また巻き込みが発生していることが分かる。このような肉の不均一な流動状態は、ラック歯の成形完了後における不均一な応力残留及びこれに伴う弾性歪の戻り即ちスプリングバック量の不均一を惹起せしめ、製品の精度低下の原因となるがこの発明においては均等な肉の流動が確保されるためこのような問題点は解消されている。

【００２３】再び図１において、芯金の上下方向のシフトについて説明すると、左右の芯金20A，20Bからなる対は上下に複数設けられている。図１には芯金20A，20Bの対の下方にもう一つの芯金20A'，20B'の対が示されているが必要な段数の芯金対が上下方向に配置されている。シフトの毎に加工が段階を追って進むようにシフト方向で作用径などの芯金の形状が漸次変化されている。複数段の芯金対は図１には示されない左右のスタッカに積載されており、スタッカをシフトしながら加工が行われるようになっている。即ち、最初の加工段の芯金20A，20Bを交互に圧入することにより第１段の加工を行った後、左右のスタッカにおける芯金ホルダは待機時に矢印ａのように上方向にシフトされ、第２段目の芯金20A'，20B'が素材管１８に整列せしめられ、芯金20A'，20B'は交互に素材管１８の内部空洞に圧入せしめられ、第２段階の加工が実施され、以下同様に必要段数の加工が実施される。このように芯金を少しづつ変化させて加工を多数段にわたって行うことにより肉薄の素材管に対しても深い凹凸形状の賦型を精度高く実現することができる効果がある。

【００２４】図４の（イ）～（ニ）はこの発明を実施しうる各種の異形素型材及びそれに凹凸形状を賦与するための金型の割り構造を説明している。図４の（イ）は図１及び２に関連して説明した円管の上半分を平坦化した素材１８Ａを示す。金型は上型１２Ａと下型１４Ａとからなり、上型１２Ａは素材１８Ａの平坦部に面して凹凸部12A-1を有しており、芯金の圧入により素材１８Ａの平坦面にこの凹凸に相補的な凹凸形状が形成される。

【００２５】図４の（ロ）は矩形断面の素材１８Ｂを示しており、素材１８Ｂは上型１２Ｂと下型１４Ｂとの間にクランプされる。上型１２Ｂは素材１８Ｂの一側面に面して凹凸部12B-1を有しており、芯金の圧入によりこの凹凸に相補的な凹凸が素材１８Ｂの一側面に形成される。

【００２６】図４の（ハ）は６角形断面の素材管１８Ｃを示しており、金型は12C，12C'，14Cからなる三つ割にされ、各割型12C，12C'，14Cの内面に凹凸12C-1，12C'-1，14C-1が形成され、芯金の圧入によりこの凹凸に相補的な凹凸を６角断面素材管１８Ｂの一つおきの側面に形成することができる。

【００２７】図４の(ニ)は３角形断面の素材管１８Ｄを示しており、金型は上型１２Ｄと下型１４Ｄとから構成され、上型１２Ｄの内面に凹凸12D-1が形成され、芯金の圧入によりこの凹凸に相補的な凹凸を３角断面素材管１８Ｄの上面に形成することができる。

【００２８】図５は素材管の平坦表面12A-1，12B-1，12C-1，12D-1に付される凹凸形状の各種のバリエーションを例示しており、Ｉは山歯列、IIは凹凸キー、IIIは凹凸の卍模様を示しており、その他この発明の実施により各種の凹凸形状ないしは模様を素材管の表面に付することができる。

【００２９】図６及び図７は図４（ロ）の実施形態において使用しうる矩形断面を有した芯金のより具体的な構造を示している。芯金１２０は先端の案内部120-1と、案内部120-1に後続する第１のテーパ部120-2と、第１のテーパ部120-2 に後続する第１の拡径部120-3と、第１の拡径部120-3に後続するテーパ部120-4と、第２のテーパ部120-4に後続する第２の拡径部120-5と、第２の拡径部120-5に後続する第３のテーパ部120-6と、第３のテーパ部120-6に後続する第３の拡径部120-7と、第３の拡径部120-7に後続する縮径部120-8と、縮径部120-8に後続しホルダの根元近くまで延びる座屈防止当たり部120-9とからなる。

【００３０】素材管への芯金１２０の圧入時に案内部120-2より芯金は素材管に導入され、第１のテーパ部120-2を介して第１の拡径部120-3が素材管の内周に係合することにより金型内周の凹凸部への素材の肉の流動が惹起される。圧入がさらに進行するとテーパ部120-4，120-6及び拡径部120-5，120-7により同様な素材の金属流動が惹起される。拡径部120-3，120-5，120-7は拡張作動中において素材の圧縮強さの数倍の単位面圧を受けることから芯金の素材は燐酸塩処理を受けたものであることが好ましい。また、作動中の油膜切れに対処するため拡径部120-3，120-5，120-7はその表面にオイルポットとなりうる極小のラビリンス溝や微小梨地模様など形成処理を施しておくのが好適である。このようなオイルポットは成形部だけでなく成形時に反力を受ける対抗側の面に設けることが好ましい。又は、オイルポットは成形部の全周に設けてもよい。

【００３１】図６では段階的に径が増大するテーパ部120-2，120-4，120-6及び拡径部120-3，120-5，120-7を設けることにより一回の圧入における肉の流動が順次行われ、トータルとしての肉の流動量を多くすることができ、生産性を高めることができる。この場合に潤滑油の封じ込めが強くなり転造による造形形状を狂わせるおそれがある。拡径部120-7の背後に設けられる縮径部120-8は封じ込められた潤滑油を逃すことによりこれを防止する機能を達成する。

【００３２】芯金の圧入を継続してゆくと当たり部120-9は素材管の内周に密に嵌り込み、芯金に加わる座屈方向の荷重を受ける機能を達成する。即ち、素材管への芯金の圧入がある深さ以上になり拡径部120-3，120-5，120-7を過ぎた芯金の根元側では当たり部120-9が素材管に僅かの隙間にて嵌合した状態で先端側での転造が進められる。そのため、長いラックバーの転造形成の場合においても当たり部120-9 により素材の安定支持が行なわれ、座屈限界に余裕を持たせることができ一回の圧入時の金属流動量を多くした場合における芯金の必要な耐久性の確保を図ることができる。

【００３３】次に、図８及び図９によってこの発明の原理による転造形成の実施としての複数本芯金同時圧入及び多段シフト方式のラックバー転造装置を説明する。図８及び図９において、３０はその上に金型を載置するためのベッドであり、横開きの割型としての複数（図では３個）の金型１１０が横方向に重ねて配置される。各金型１１０は二つの割型112，114より構成され、一方の割型１１２は図２と同様にラック歯状の凹凸を有しており、他方の割型１１４は円管状の素材を収容するための半円形溝を形成している。

【００３４】ベッド３０上における金型１１０の並び方向における一側に加圧シリンダ３２が設けられ他側に受圧枠３４が配置される。加圧シリンダ３２はピストン32-1を備え、ピストン32-1が引き戻された状態では図８の上半分（一点鎖線Ｌから上）に示すように各金型１１０はそれを構成する横割の割型112，114が分離され（図２の（イ）も参照）、その間に素材管を挿入するための空間Ｓを形成することができる。油圧の供給によって加圧シリンダ３２のピストン32-1が図８の下半分に示すように加圧のために前進されると、割型112，114はベッド３０上を横方向に移動され、横重ねされた金型１１０はピストン32-1と受圧枠３４との間に挟着保持され、各金型１１０を構成する割型112，114は図２の（ロ）に示すと同様に合体され図８の下半分に示すように割型112，114の間に素材管１８（破線にて示す）がクランプされる。

【００３５】金型１１０の横重ね方向と直交する方向の両側において、即ち、割型112，114によりクランプされた素材管１８の軸線方向の両端側にスタッカ36A，36Bが配置される。図９に示すように左側のスタッカ３６Ａは上下方向に多段に配置された芯金ホルダ38A-a，38A-b，38A-c（図示では芯金ホルダの個数は３であるがそれ以外の任意の必要な数の芯金ホルダを具備させることができる）と、これら芯金ホルダ38A-a，38A-b，38A-c を上下摺動自在状態に保持するスタッカ枠４０Ａと、スタッカ枠４０Ａ内での芯金ホルダ38A-a，38A-b，38A-cの上下動を行わしめる昇降機構４２Ａとから構成される。芯金ホルダ38A-a，38A-b，38A-cの各々は所定本数の芯金20Aをワンタッチ式に着脱可能な構造となっている。また、左側芯金ホルダスタッカ３６Ａの外側には圧入制御用油圧シリンダ４４Ａが設けられ、圧入制御油圧シリンダ４４Ａのピストン44A-1はスタッカ３６Ａに保持される芯金ホルダ38A-a，38A-b，38A-cに順次係合され、選択された芯金ホルダを図の右から左に移動させ、その芯金ホルダに保持された芯金を金型にクランプされた素材管１８の内部空洞に向けて圧入し、図１で説明したように素材管の外面に金型内周に形成される凹凸に順じた形状の凹凸を付与する。

【００３６】一つの芯金ホルダ38A-aに保持された複数本の芯金20Aによる圧入が終わると、芯金ホルダ38A-aはスタッカ枠４０Ａの部位まで左方向に後退され、昇降機構４２Ａによってスタッカ枠４０Ａ内の芯金ホルダは上下方向（例えば上方向）に一段シフトされ、ピストン44A-1により次の加工順の芯金ホルダ38A-cが図９の右方向に押し出され、芯金ホルダ38A-cに保持された芯金20A'は素材管１８の軸方向内部空洞に圧入され、次の段階の転造操作が実施される。

【００３７】図９において金型ベッド３０の右側に配置されたスタッカ３６Ｂの構造は左側のそれと同様であり、上下方向に多段に配置された芯金ホルダ38B-a，38B-b，38B-cと、芯金ホルダ38B-a，38B-b，38B-c を上下摺動自在に保持するスタッカ枠４０Ｂと、スタッカ枠４０Ｂ内での芯金ホルダ38B-a，38B-b，38B-cの昇降を行わしめる昇降機構４２Ｂとから構成される。また、右側芯金ホルダスタッカ３６Ｂの外側には圧入制御用油圧シリンダ４４Ｂが設けられ、圧入制御油圧シリンダ４４Ｂのピストン44B-1はスタッカ３６Ｂに保持される芯金ホルダ38B-a，38B-b,38B-cに順次係合され、選択された芯金ホルダを図の右から左に移動させ、芯金ホルダに保持された芯金を金型１１０にクランプされた素材管１８の内部空洞に向けて圧入し、図１で説明したように素材管の外面に金型内周に形成される凹凸に順じた形状の凹凸を付与する。また、昇降機構４２Bによってスタッカ枠４０Ｂ内の芯金ホルダは上下方向に一段づつシフトされる。

【００３８】圧入段階の進行に応じて左右の芯金ホルダのシフトは連動的に行われるが、かつ各段階において左右の芯金は図１に関連して説明したように交互に素材管１８に圧入される。即ち、図９においては第２段階の転造操作が実施されており、左側の芯金ホルダ38A-bに保持された芯金20Aが圧入シリンダのピストン44A-1により右方向に移動された芯金２０Ａは横重ねの各金型１１０にクランプされたそれぞれの素材管１８に一斉に圧入され、その圧入が終わると芯金ホルダ38A-bに保持された芯金20Aは左側に引き戻され、その引き戻しとラップさせて右側の第２段目の芯金ホルダ38B-bに保持された芯金２０Ｂが圧入シリンダ４４Ｂのピストン44B-1により図９の左方向に移動され、芯金２０Ｂは横重ねの金型１１０にクランプされたそれぞれの素材管１８に一斉に圧入される。そして、このような芯金ホルダ38A-b，38B-b

の左右の圧入は図１に関連して説明したと同様に複数回繰り返して実施される。この段の転造操作が完了すると、左側のスタッカ及び右側のスタッカのシフトが所定方向、例えば上方向に実施され、次の段のための芯金ホルダ38A-c，38B-cに保持された芯金20A'，20B'が複数本同時に左右に交互に素材管に圧入され、この段階の転造操作が実施される。

【００３９】図８及び１０の転造方式においては、それぞれが横割の複数の金型１１０が横重ねされ両側から加圧することにより各金型を構成する割型112，114を合体保持するようにしている。金型に保持された素材管へ芯金を圧入した場合に金型が芯金圧入力によってベッド３０上で受ける転倒モーメントＭはベッドから金型の中心までの距離Ｌに加圧力Ｐを掛けたものであり、Ｍ＝Ｌ×Ｐとなるが、複数の金型を横重ねとしているため、転倒モーメントの値は金型が一つの場合と全く同一となる利点がある。

【００４０】また、芯金圧入時の金型１１０を閉鎖状態に保持する油圧シリンダ３２による加圧力については複数の金型を加圧方向（横方向）に重ねた場合の保持力は近接金型間の反力の打ち消しにより、一個の金型を保持する加圧力と同一であり、複数金型のため油圧シリンダ３２として大型のものを採用する必要はない。

【００４１】この発明の実施形態においては、心金20A，20Bの移動方向と金型１１０の移動方向とは水平面内であるが、図８に示すように相互に十字状に公差している。従って、図９に示すように金型１１０の上方は実質的に全て開放した空間を形成している。従って、ワークである新規な素材管１８´の金型１１０への装填及び製品の取出しはローダー１１１により矢印b1，b2のように上下方向に行うことができる。また、金型の上方の空間が完全に開放しているため、そのメンテナンスが容易となる効果がある。また、心金ホルダ38A-a，38A-b，38A-c，38B-a，38B-b,38B-cのためのスタッカ枠40A，40Bも上方に開放しうる構造となっているためそのメンテナンスも容易化することができる。

【００４２】図１０及び図１１は各金型１１０を構成する割型112，114における清掃液噴射ノズル、噛みワーク突出装置を示している。即ち、連続成形による塑性加工の発熱の過剰蓄積には大量の冷却液のシャワーリングを必要とする。また、一回だけのクランプ後の連続成形終了時のワーク取り出し作業用の金型開口時には凹凸転造金型面とその反対側のクランプ面に同時に洗浄液を強力に噴射して、燐酸塩皮膜処理用のカスその他のゴミを毎回除却して、金型の清潔度を保ち、傷の発生を防止する必要がある。そのためには、洗浄液とベッド面との落差距離を短くし迅速な洗い流しが行われるように図ることが望ましい。即ち、割型112，114の成形面に噴射ノズル112-1，114-1が開口しており、転造後に割型が開けられるときに噴射ノズル112-1，114-1から清掃液が相手方の割型に向け噴射され、清掃及び冷却を行うことができる。また、噛みワーク突出装置はピン112-2，114-2により構成され、ピン112-2，114-2の突き出し操作によって型の内面に噛み込んだワークを突き出すことができるようになっている。この構造採用によって、一回のクランプの傷発生防止をもたらすことができる。

【００４３】図１２及び図１３は芯金圧入用のシリンダの具体的な支持構造の一例を示す。図１２及び図１３は簡明のため金型１１０の右側の芯金圧入用の油圧シリンダ４４のみ示されているが図９に順じて金型１１の左側にも同様な油圧シリンダが設けられる。１３０は油圧シリンダ支持台であり、油圧シリンダ支持台１３０上には断面コの字状の支持枠１３２が取り付けられる。支持枠１３２の上辺の内面からは一対の間隔をおいた逆撓みリブ１３４が片持ち状に垂下形成される。逆撓みリブ１３４には油圧シリンダ４４の本体が固定される。油圧シリンダ４４からはピストンロッド44-1が延び、ピストンロッド44-1の先端に芯金ホルダ３８が取り付けけられ、芯金ホルダ３８に芯金２０が保持される。ピストンロッド44-1が伸張すると、ピストンロッド44-1の先端の芯金ホルダ３８及び芯金ホルダ３８に保持された芯金２０が伸張し、型１１０上の金型１１０に保持された素材管１８に圧入され、素材管１８の平坦化された表面に模様付けが行われる。

【００４４】図１２及び図１３の逆撓みリブ１３４の作用を説明すると、油圧シリンダ４４は片持ち取り付けであり、素材管１８に対する芯金２０の圧入時の応力によって支持枠１３２は上向きに撓む。支持枠１３２のこの撓みをそのままで、即ち、支持枠１３２に直接油圧シリンダ４４を設けていたとすると、芯金２０の加圧軸心を上向きにずらせ、芯金２０の寿命短縮の原因となる。これに対して図１２及び図１３の実施形態では油圧シリンダ４４は支持枠１３２の上方板から片持ち取り付けされる逆撓みリブ１３４に設置されている。素材管１８に対する芯金２０の圧入時の応力による逆撓みリブの撓み方向は支持枠１３２の撓み方向と反対の下向きである。従って、逆撓みリブ１３４を適切に設計することにより支持枠１３２の上向きの撓みを逆撓みリブ１３４の下向きの撓みにより相殺することができ、芯金２０の加圧軸心のずれが生じない又は小さくなるため芯金２０の寿命を延長することができる効果がある。

【００４５】図８及び図９の装置に使用する金型１１０を構成する割型112，114の構成について説明すると、加工精度として高いものを必要としない場合や形状が加工容易なものについては、既に図２に関連して説明したように凹凸成形型そのものをクランプ型として構成することができる。しかしながら、精度を要し形状加工の難度の高いものについては凹凸成形部そのものを単独加工し、その型をクランプ割型に埋設した構成とする必要がある。この場合クランプ割型を割型ホルダとする。この

場合において、傷発生防止のための洗浄液の強力型噴射ノズルは最短距離での設置の観点からこの割型クランプに埋め込まれる。また、ワークが万一噛み込んだ場合は、ワーク取り出し装置の破損を招くおそれがある。従って、クランプ型にはワークの強制取り出し装置を組み込むことが好ましい。また、ワークの開口にばらつきがあると、ワークの供給不良を招き、生産性阻害の要因となることから、これを排除するための噴射ノズルワークノックアウト型開口寸法規制などの装置を組み込むことが好ましい。

【００４６】次に芯金ホルダの多段シフト式の装置によって複数の品種の製品を段取り変えなく加工する場合について説明する。まず、芯金ホルダに保持される芯金の数について説明すると、芯金の数は奇数が好ましく図８では３であり、図１４のように芯金ホルダ38A，38Bにそれぞれ５個の芯金を保持するようにしてもよい。異なった品種の同時成形にあたっては各種の形成圧入力が異なる場合であっても芯金圧入シリンダへの偏心荷重が発生しないようにする必要がある。図１４ではA，B，Cの三品種の同時加工を行い、その生産量がＡ＜Ｂ＜Ｃの場合を想定しており、生産本数の少ないＡを中心でその両側でＢを最も外側でＣを加工するようにするとバランスをとることができる。また、生産量の少ない品種は当然、芯金一本での成形で間に合うものとする。また、５本の芯金A，B，Cを芯金ホルダにフル装備した場合でもＡ種のみ生産不必要となった場合は図１４に示すようにＡ種用の素材管１８を金型１１０に供給しなければＡ種用の芯金クランプ型における芯金を脱着せずにそのままで加工を続行することができる。

【００４７】次に、図８及び図９に示す芯金ホルダの多段シフト式の装置によって複数の品種の製品を段取り変えなく加工する場合について説明する。６工程で製造されるＡ系列の製品と、１０工程で製造されるＢ系列の製品を左右に８段のスタッカを備えた機械により製造する場合を例に挙げると、Ａ系列は左右のスタッカの上側３段、Ｂ系列は左右のスタッカの下側５段を使用する。上段から開始しスタッカからの芯金の取出し、芯金の圧入、引き戻しを左右交互に６工程行うことで、Ａ系列の製品の製造を行うことができる。また、下側５段のスタッカについて左右交互に行うことでトータル１０工程が実施され、Ｂ系列を製品を得ることができる。また、それぞれ８工程にて製造しうる系列Ｃ，Ｄの場合は系列Ｃ，Ｄについて左右の上下４段づつ使用することにより段取り変えなしですませることができる。

【００４８】図１５は無段取り変えで多種類の同時加工を行う各種の組み合わせ例ａ～ｒを示している。被加工素材管の形態をシンボリックに○△□にて示している。図１５の（イ）は一つの芯金ホルダ38A，38Bによる同時加工時の組み合わせを示しており、この場合は図１４において説明したように奇数の心金が偏心荷重が生じないように対称配置されている。図１５の（ロ）は左右のスタッカ36A，36Bにおけるシフト方向（上下方向）での組み合わせを示しており、生産する品種の組み合わせに応じて適当な組み合わせを採用する。即ち、ａ，ｇ，ｍは○、△、□の単品のみの注文しかない場合である。注文数が少なければ素材管をセットする金型を少なくすればよい。○及び△の注文がありうるのであれば例ｂやｈの組み合わせとなり、○及び△の注文数に応じて素材管のセット数を調節する。従って、段取り変えなしに、換言すれば、芯金及び金型の配置をそのままにして必要な品種を必要な数生産することができる。○、△、□の三品種の生産が必要な場合にはその生産数の比率に応じて例ｃ，ｄ、ｅ，ｆ，ｉ，ｊ，ｋ，ｌ，ｎ，ｏ，ｐ，ｑ，ｒなどのいずれかが選択され、この場合も三品種の同時加工を段取り変えなしに行うことができる。

【図面の簡単な説明】

【図１】図１はこの発明における成形転造の原理を説明する図である。

【図２】図２は金型の断面図であり、（イ）は開放状態（ロ）は閉鎖状態を示す。

【図３】図３は金型の凹部への素材の流れ状態を模式的に示す図であり、（イ）はこの発明、（ロ）は従来技術を示す。

【図４】図４は金型の各種の断面形状を示す図である。

【図５】図５はこの発明により形成しうる凹凸形状の一例を示す図である。

【図６】図６は芯金の側面図である。

【図７】図７は芯金の正面図である。

【図８】図８はこの発明の実施である芯金多段シフト型同時多数加工式の装置の概略的平面図である。

【図９】図９は図８の装置の側面図である。

【図１０】図１０は割型を分離した状態で示す金型の長手方向断面図である。

【図１１】図１１は図１０の金型の横断面図であり、図１０のXI－XI線に沿って表わしたものである。

【図１２】図１２は芯金加圧のための油圧シリンダの加圧軸心の歪矯正装置を示す側面図である。

【図１３】図１３は図１２のXIII-XIII線に沿って表される矢視断面図である。正き１は図１０の金型の横断面図である。

【図１４】図１４は多種同時加工を行う場合の芯金ホルダにおける芯金配置を示す図である。

【図１５】図１５はこの発明により多段シフト同時多種加工における無段取り変え加工方式を説明する図である。

【符号の説明】

１０…金型
１２…上型
１４…下型
１８…円管

15

20A，20B…芯金
20A'，20B'…芯金
20A"，20B"…芯金
20-1…芯金の案内部
20-2，20-4…芯金のテーパ部
20-3，20-5…芯金の拡径部
３２…加圧シリンダ
３４…受圧枠
36A，36B…スタッカ
38A-a，38A-b，38A-c…芯金ホルダ
38B-a，38B-b，38B-c…芯金ホルダ

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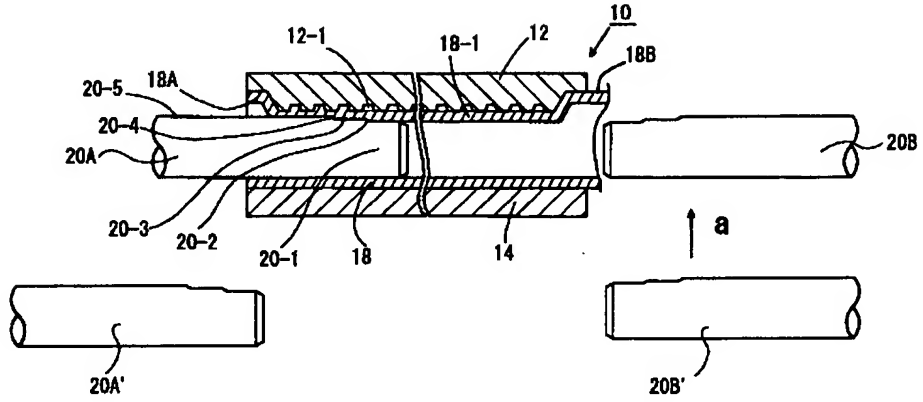
＊40A，40B…スタッカ枠
42A，42B…昇降機構
44A，44B…圧入制御油圧シリンダ
44A-1，44B-1…圧入制御油圧シリンダのピストン
１１０…金型
112，114…割型
１２０…芯金
120-1…案内部
120-2，120-4，120-6…テーパ部
120-3，120-5，120-7…拡径部
＊

【図１】



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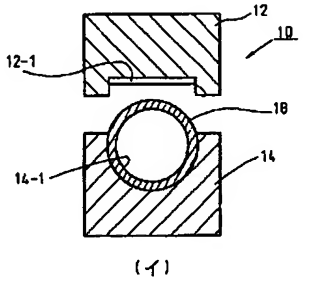

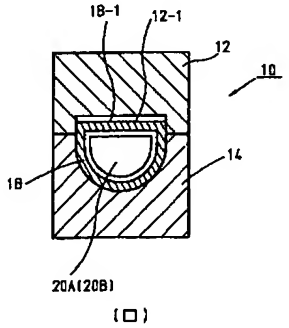

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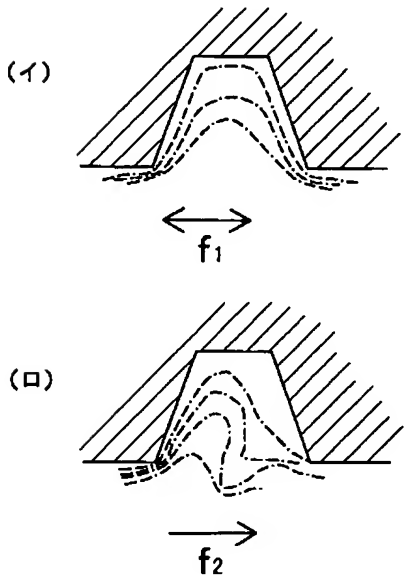

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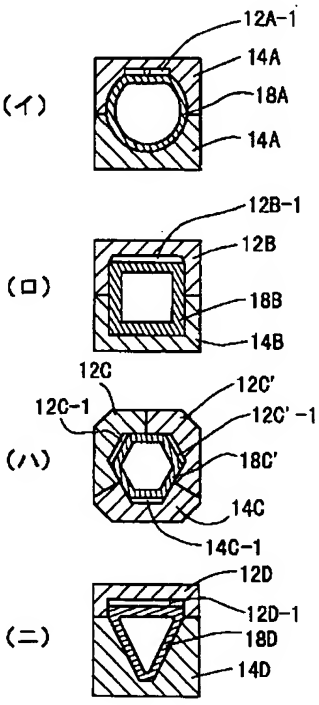

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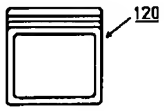

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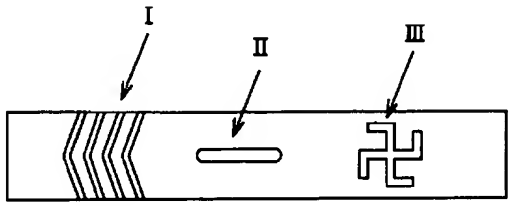

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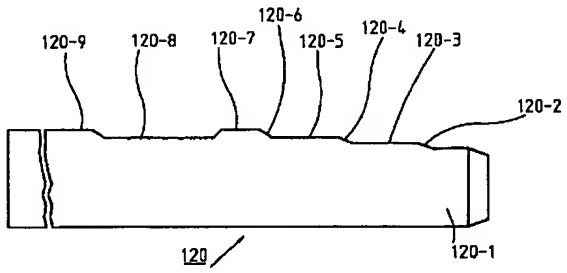

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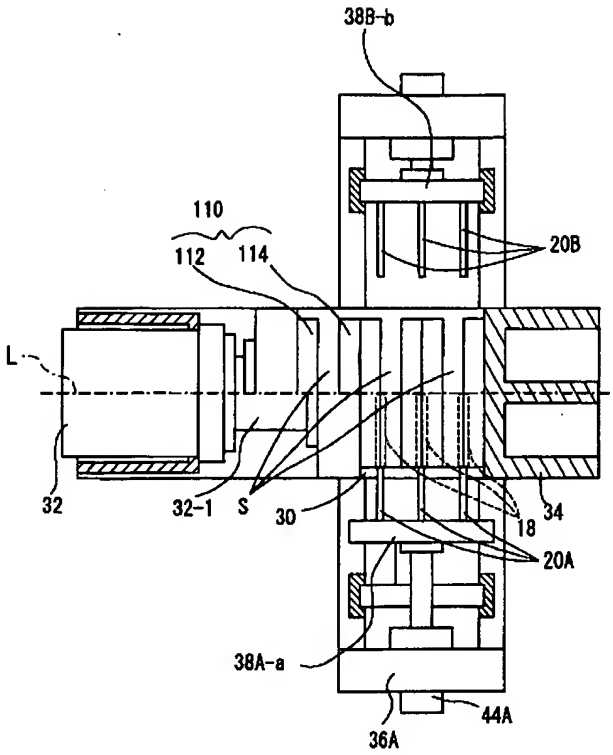

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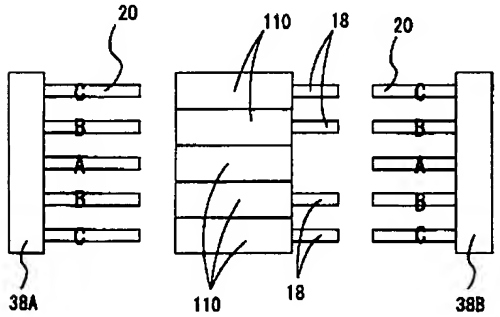

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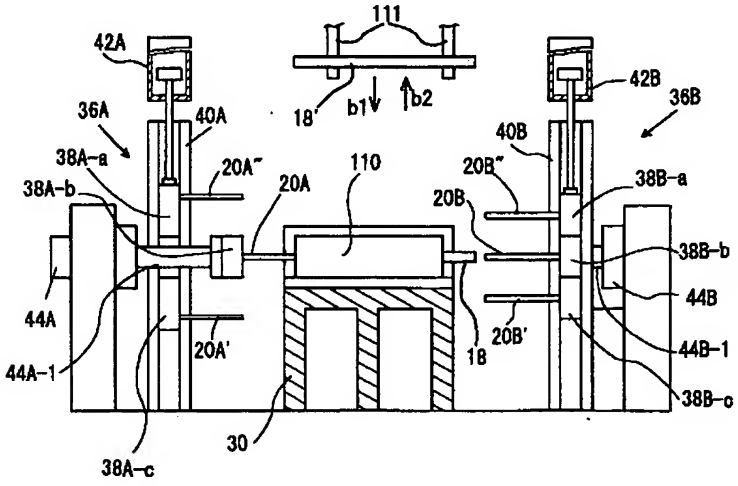

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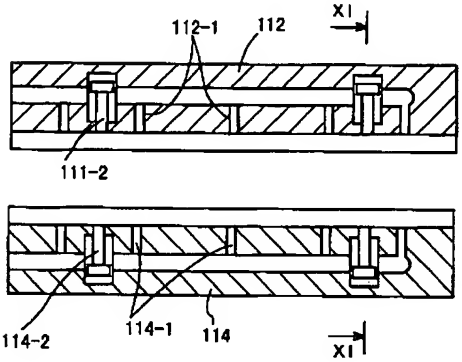

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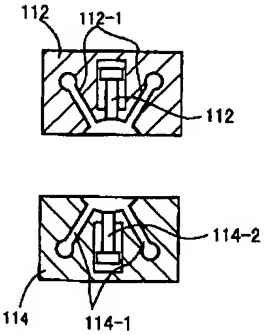

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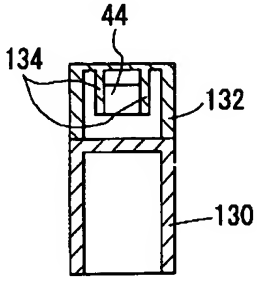

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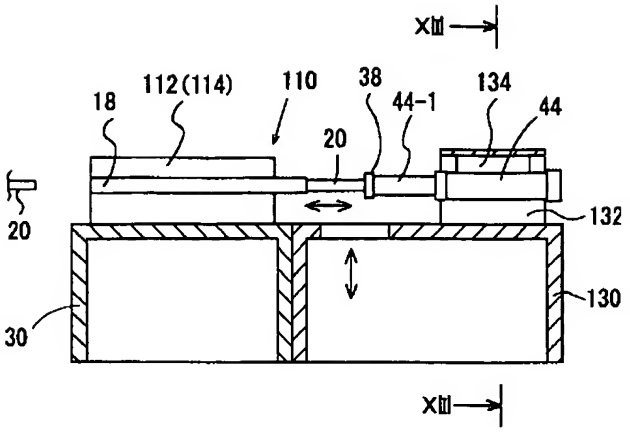

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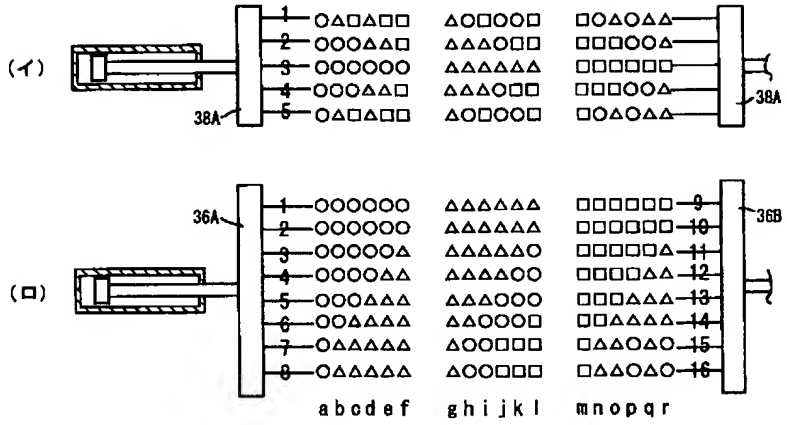

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	B30B 7/00		B30B 7/00		
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//	B21D 17/02		B21D 17/02		
	51/16			51/16	Z
	53/88			53/88	Z
	B21K 1/76		B21K 1/76		A